THE

DENTAL PRACTITIONER

incorporating

THE DENTAL RECORD

VOL. V, NO. 9 MAY, 1955

Including the official reports of the British Society of Periodontology, the British Society for the Study of Orthodontics, the European Orthodontic Society, the Liverpool and District Odontological Society, the North Staffordshire Society of Dental Surgeons, the Odonto-chirurgical Society of Scotland, and the British Society of Dental Hypnotists

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Illustrations should be clearly numbered and legends should be written on a separate sheet of paper and not put on the backs of the originals. Each figure should be referred to in the text. Prints are preferred to X-ray negatives and should be on glossy paper. Lettering which is to appear on illustrations is best shown on an overlay or rough sketch. It should not be put on the original.

Tables should be typed on separate pages and each should have a caption which will explain the data without reference to the text.

References to dental literature should be recorded in the text, with the name of the author and the year of publication in parentheses. In the bibliography they should be arranged in alphabetical order in the following form, the abbreviations of periodicals being those adopted in the *World List of Scientific Periodicals* (1952), e.g.:—

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THE
DENTAL PRACTITIONER

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EDITORIAL

HYPNOSIS

THE report on hypnosis by the British Medical Association is of important interest to dentistry. A section of the profession has always been keenly concerned in this art and many investigations by dental surgeons have been undertaken on its relationship to anæsthesia and analgesia in dental surgery. This stimulating report will give satisfaction to those who, against much criticism, have held the view that hypnosis has a definite place in dentistry. It has been widely used in the U.S.A. for some years and numerous articles and text-books have been published on the subject. There are a number of societies for dental hypnosis in the U.S.A. and one in this country which have popularized this adjunct to treatment since the war, and courses in hypnosis have been given to many practitioners. Hypnosis in dentistry is something that already exists, so there is no likelihood that a wave of hypnotic influence will follow this report. It is not a method of treatment to be entered into lightly without a full understanding of the method and application. Its disadvantages and restrictions must be carefully weighed against its advantages and scope; a knowledge of what it will not do as well as what it will is equally essential. It requires a high degree of concentration and patience to perform this art, which may be practised by any competent person, but it is not the easy way out for the difficult patient. Where all else fails, hypnosis will fail, unless a course of treatment in hypnosis is performed first and then only on a receptive patient. The fractious and highly nervous patient whom one would like to hypnotize immediately is the difficult patient for hypnosis, and a frayed temper is not conducive to hypnosis in the busy practice. It is not difficult to train a person in hypnosis, but once trained the technique must be used constantly. It is not something that can be kept up the sleeve for the odd case every now and then. It must be practised assiduously and attention to method and application must not be relaxed. Hypnosis in dentistry is not a panacea for the difficult patient, but it may be used in place of an anæsthetic or as an analgesic. As such it has a useful place in the armamentarium of the dental surgeon. It would be quite wrong for the profession to use it on any other basis.

EVALUATION OF A NEW ANÆSTHETIC AGENT IN DENTISTRY

A PRELIMINARY REPORT ON 114 CASES OF THIOSECONAL

By **W. H. MYERS**, M.R.C.S., L.R.C.P.

THIS report concerns an entirely new anæsthetic agent, which at the time of writing is not yet for sale on the British market, but which has been supplied to me for clinical trial in dentistry, and a clinical demonstration of which I had the pleasure of offering before a meeting of the Society of Dental Anæsthetists at Conway Hall, Red Lion Square, on Dec. 14 last year.

This drug is an intravenous anæsthetic, very similar to the several other intravenous drugs on sale in this country. It is made up for use by dissolving the contents of one half-gramme ampoule in 20 c.c. of distilled water, specially distilled for intravenous use. The most convenient vial I have found is the 25-c.c. rubber-capped bottle made by Messrs. Allen & Hanburys and called "Apyrogen".

An autoclaved 10-c.c. syringe is used to remove from the vial 5 c.c. of the water, which is rejected. From the remaining 20 c.c. a further 10 c.c. is taken and used to dissolve the thioseconal powder. This is returned to the vial, so that in the vial is 20 c.c. of a 2·5 per cent solution. It is injected in the usual way into the veins of the antecubital fossa, slowly and deliberately. I always inject about $\frac{1}{2}$ c.c. very slowly and wait to make quite sure that the needle is intravenous and not perivenous or intra-arterial, the former being shown by a bulge in the skin, and the latter by the patient complaining of intense pain in the arm, with signs of vascular spasm distal to the injection site. In such cases appropriate measures should be taken as for barbiturates in general.

The usual dose of the new drug is about 10 c.c. for an adult of from 16 to 70 years of age—which contains a $\frac{1}{2}$ gr. The effect is similar to the other intravenous barbiturates except that here I noted very little if any apnœa, and in no case was there any laryngeal spasm. At first there was a flickering of the eyelids and a fair amount of relaxation, very much more depth and relaxation than one would expect considering we were using such a minute dose of drug, in this instance only a $\frac{1}{4}$ g., approximately $3\frac{3}{4}$ gr. of the powder.

As we are dealing with human beings and not a machine it is impossible to forecast dogmatically the required dose for this or that particular age or weight, and although I have tried to keep accuracy in my records, I still find it difficult to say in advance what dose is the correct one or indeed what reaction may be expected in every case.

The drug has one advantage in this respect in that for an average man or woman one can safely start with 10 c.c. and in this series I have seldom exceeded this.

But, in a retrospective consideration of this series, I formed a general overall impression, in comparison with results obtained in a long experience with other intravenous barbiturates, that here we have a drug which gives us ultra-short action, probably shorter than the others, with an adequate safety margin as judged by the breathing and absence of spasm and apnœa, and finally a fast emergence from the sleep.

As to what technically constitutes recovery from the anæsthetic is somewhat arbitrary. Some workers suggest that the patient should phonate and should be able to get up and walk about—another worker suggests that recovery is when the patient talks intelligently. In this series I made my standard the return of the usual reflexes—eye, cough, and swallowing—and set a proviso that all cases should be up and out of the dental chair within 10 minutes and any case not conforming to this standard should be remarked on, and in this series all cases did conform to the 10-minute limit, and, indeed, a number were on their way home by that time.

From my records, and all times were done with a stopwatch, I have found that we have been able to extract as many as twenty-four teeth with a single administration of 10 c.c., and with no supplement, and the patient has had all his reflexes back, spitting and answering me within 30 seconds. Almost as quick as gas many may remark, but I would venture to suggest that it is quicker.

This does not always happen; one case I had in hospital out-patients was a young athlete of 23 years who had dislocated his finger at rugby and to whom I gave a $\frac{1}{4}$ g. He weighed 15 st. and was all brawn, but the small dose I gave him was plenty; in fact he recovered in about a minute, but he detoxicated it slowly from thereon, and was dizzy for fifteen or twenty minutes afterwards.

Another case, a bricklayer who was given a dose of 10 c.c., appeared not to have been anæsthetized at all with this dose, yet after re-introduction of the needle and a further administration of 5 c.c.—15 c.c. in all—he had a peaceful sleep and all his fifteen teeth were easily extracted, and he made a recovery in half a minute, having been asleep for 8 minutes. He was out of the room in less than 10 minutes.

The dose in this series was 10 c.c., the average sleep time available for operating was a fraction over 3 minutes, and the usual time for recovery to reflexes was 30 seconds —I say usual here and not average, as several cases were a little longer in recovery to reflexes, and the inclusion of these cases causes the average to be higher than is usual in practice. In all cases the patient was out of the chair well within 10 minutes. For the worked-out averages *see Table I*, and compare with the figures in *Table II* for a thiopentone series by another worker.

Table I.—Averages in a Series of 114 Cases using 2·5 per cent Thioseconal

Age	34 yr.
Weight	10 st.
Amount of 2·5 per cent solution	10 c.c.
Weight of powder	0·25 g.
Number of teeth per patient	9
Operating time	3 min. 13 sec.
Recovery time to reflexes	50 sec.

It will be seen that some of these cases were not completed without some supplementation with another anæsthetic—either because the time factor dragged on owing to unexpected difficulty in extraction, and this was the main reason for supplementation, or in a few cases, although the patient slept, it was impossible to extract teeth on the dose given initially as the patient was resistant and reacted to pain. In all the cases, the supplement was gas, trilene, and oxygen administered from a Walton machine, the nitrous oxide given at 80 per cent N_2O, 20 per cent O_2, and a mere analgesic dose of trilene. This made no difference to the recovery of the patient, who in every case was totally unaware that anything other than an intravenous method had been used. In cases where the operation was very prolonged, then as usual, whether an intravenous anæsthetic is used or not, there is a corresponding longer period of lethargy afterwards, as no doubt the patient becomes anæsthetic soaked.

Table II.—Averages in a Series of Thiopentone Cases*

Amount of drug	0·35 g.
Number of teeth	17·4
Operating time	3 min. 4 sec.
Time to talk intelligently	3 min. 59 sec.

* From *Intravenous Anæsthesia in Dentistry* (S. L. Drummond-Jackson), 1952, 96–97. London: Staples Press.

Again, as is well known, there are some people who never recover quickly, and would have the same lethargy if they had only local anæsthetic; of course I met a proportion of these—indeed, I would say that I met more than my share, as the primary object of the patients in seeking the intravenous method was because of nervousness, so the general picture was that of neurotic and nervous individuals.

These neurotic patients were more difficult and overcame their apprehension more slowly than the robust individual. I had a 7-st. woman who had to be supplemented from the beginning because of her restlessness, while a burly, 15-st. ex-policeman needed no supplement and had six teeth out, sleeping peacefully the whole time.

The usual precautions were observed by giving the patient on booking a printed card,

Table III.—CARD GIVEN TO THE PATIENT

Instructions for injection anæsthesia—Pleasant sleep from a simple injection in the arm.

1. Bring a clean towel.
2. You *must* be accompanied by another adult.
3. Do not eat or drink for four hours before your appointment.
4. *No driving* for four hours afterwards.
5. Do not return to work without our sanction.
6. Never use mouthwashes after extraction.
7. Bleeding is easily stopped by biting hard and continuously on cotton-wool.
8. Ask the nurse where the toilet is and use it.

Your appointment is for *o'clock on* .

bearing the name and address of the surgeon, and simple instructions to help the patient. The layout is shown in *Table III.*

As a final evaluation of this new drug I would say we have a new and valuable addition to the barbiturate series; the smaller amount required to produce at least equal depth and relaxation to that with thiopentone probably makes for a quicker recovery, while the drug itself appears initially more potent.

Table IV.—GENERAL INFORMATION ON THE SERIES

Cases supplemented	61
Cases not supplemented	53
Females	63
Males	51
Females supplemented	28
Males supplemented	33
Oldest person	70 years
Youngest person	13 years

I would like to thank Messrs. Eli Lilly & Co., Ltd., of Basingstoke, for making available the experimental supplies of the drug.

I understand from a personal communication from this firm that it is their policy not to make the drug commercially available until such time as they have received a number of detailed and favourable reports.

THE DESIGN OF REMOVABLE APPLIANCES FOR THE ROTATION AND ROOT MOVEMENT OF TEETH

By **C. P. ADAMS**, B.D.S., F.D.S.

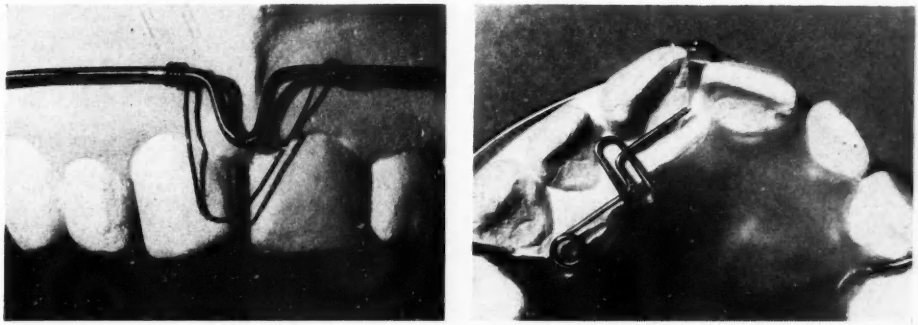
REMOVABLE appliances are not on the whole as efficient as fixed appliances for rotation and root movement of teeth, and it is important, therefore, to exercise discretion in attempting these movements with removable appliances. There are, however, certain rotation and root movements that removable appliances can perform quite well and it is helpful to bear these possibilities in mind when considering treatment problems.

The production of a rotary movement requires the application of two equal and opposite pressures acting at a distance apart to produce a *mechanical couple.** This will produce rotation about a point somewhere between the lines of action of the two forces. It is therefore necessary to find on a tooth to be rotated, two points at a suitable distance apart on which pressures in opposite directions may be applied, and this requirement automatically eliminates the possibility of rotating certain teeth. For instance, canines, upper and lower, are of a rounded shape which does not offer two points near the outside of the contour of the tooth to which suitable pressures may be applied. Lower incisors, again, are so small in section that the forces even when applied at the extreme ends of the incisal edge are so close together that an effective mechanical couple cannot be produced.

It is important when constructing appliances for rotation and root movement to ensure that the springs act exactly at the points intended and do not slide away to some other nearby

* " A couple consists of two equal parallel forces which act in opposite directions. When acting on a rigid body, it cannot produce motion in any particular direction since the algebraic sum of its resolved parts in that direction is zero; it follows that its effect is to produce rotation."—Burchardt, W. G., *A School Certificate Mechanics and Hydrostatics.*

but unsuitable point. For this reason it is sometimes necessary to make springs rather stiff in order to ensure accuracy of application to the teeth and to accept the short range of action inherent in such springs. The straight cantilever spring as used in other situations should be used as far as possible, as this spring can be made to act with the greatest precision on any desired part of a tooth. These springs may, as before, be made of varying thicknesses of wire with various numbers of coils at the point of attachment.



A B

Fig. 1.—A, This cantilever spring (0·3-mm. thick), attached to the arch by soldering, impinges only on the mesial edge of the tooth. The wide curve of the spring gives stability mesiodistally. B, The lingual spring (0·5-mm. thick) impinges on the distal edge of the tooth so completing the *couple*.

ROTATION OF UPPER INCISORS

This may be done with two cantilever springs pressing at opposite ends of the incisal edge producing the mechanical couple already referred to. In the example shown, *Fig.* 1 A, B, the two springs differ in range of action but the pressures they exert are the same. It will be seen that these springs are designed to act as near to the outer edge of the tooth as possible. The lingual spring is cranked to increase the efficiency of the guard, and the operating end is bent so as to impinge exactly on the outer edge of the tooth. The labial spring is made in a wide curve so as to be as stable as possible in a mesiodistal direction and so that slight accidental alteration in its mesiodistal position will not affect the point of application of the spring. It is thus possible to secure precision in the point of application of the pressure with a long range of action, without making the spring too stiff and rigid. This is not always possible of achievement in other situations.

Upper lateral incisors can usually be rotated in the same way as central incisors provided that the crowns are well formed and there is a definite, straight incisal edge.

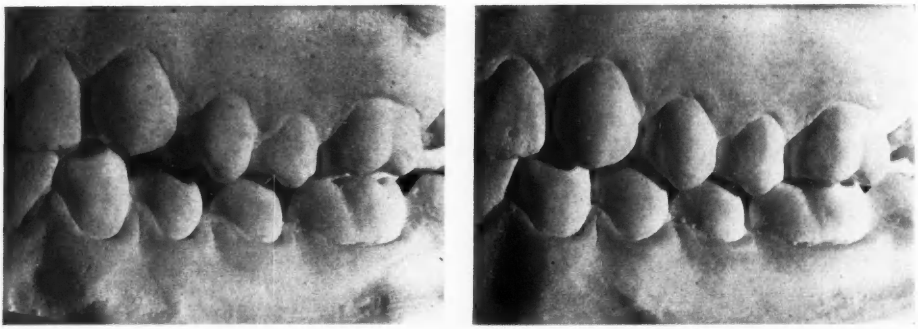
ROTATION OF CANINES AND LOWER INCISORS

As already mentioned, the rotation of these teeth is not readily performed with removable appliances and is in fact much better performed with fixed appliances.

ROTATION OF PREMOLARS AND MOLARS

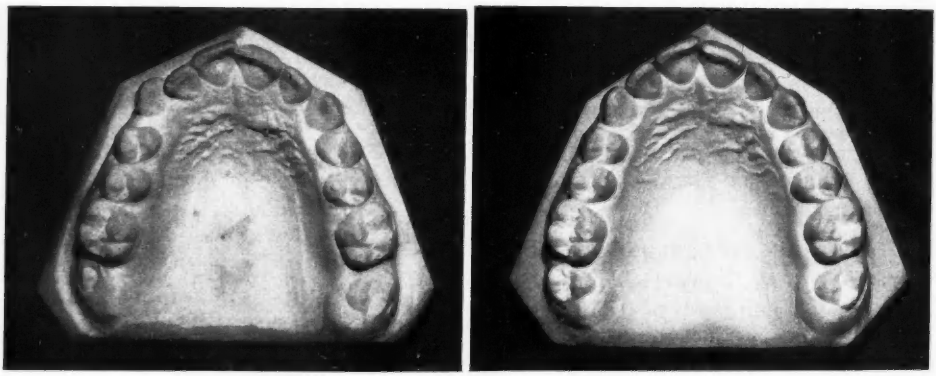
The rotation of these teeth is not a very frequently required movement, and in many cases in which such rotation is required a fixed appliance will be necessary in order to ensure accuracy of placement of the crown in its new position and to ensure rotation of the tooth about the desired axis. There are, however, certain situations in which premolars and molars can be rotated with a straightforward removable appliance. A common misplacement of the upper first premolar is to find the lingual cusp rotated mesially and biting buccally to the lower first premolar (*Figs.* 2 A, 3 A). Rotation of the upper premolar

by swinging the lingual cusp distally will produce correct occlusion (*Figs.* 2 B, 3 B). This rotation may be performed by pressing firmly on the mesial surface of the tooth opposite the lingual cusp. The buccal cusp rests against the mesial surface of the tooth behind and the tooth rotates about its point of contact with the second premolar (*Fig.* 4 A, B). It will be noticed that here only one force is used and that the place of the second is taken by a fixed point, the point of contact, between the first and second premolars. We have, therefore, in this case not strictly a couple but a force rotating about a point. The value of the force for rotation purposes is given by the *moment* of the force about this point.* As the distance between the line of action of the force and the point is comparatively small, the value of this moment is low, hence the rotating effort is small. It is found clinically that rotations such as this take a considerable time.



A B

Fig. 2.—Distal rotation of upper first premolar producing correct occlusal relation with the lower. The condition was bilateral.



A B

Fig. 3.—The rotation of upper first premolars distally by means of pressure on the mesiolingual aspect.

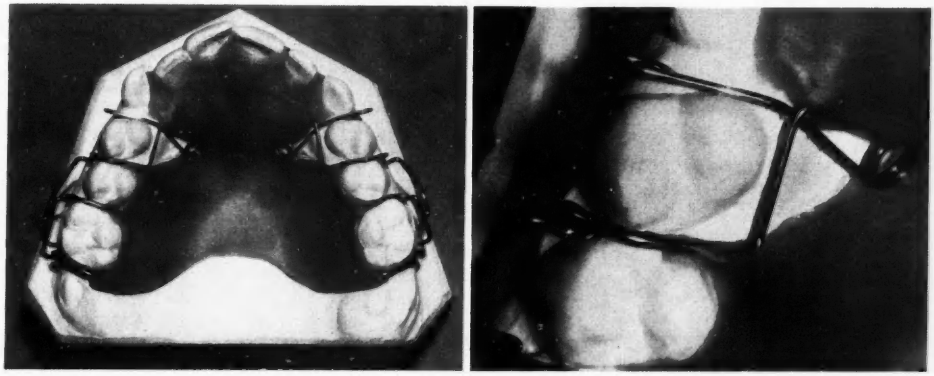
The rotation of lower premolars in this way is not likely to be very successful as these

* "The tendency of a force . . . to turn a body round a given point . . . is measured by the product of the magnitude of the force and the length of the perpendicular drawn from the point on its line of action, this product . . . being called the moment of the force about the given point."—Burchardt, W. G., *A School Certificate Mechanics and Hydrostatics.*

teeth are usually almost circular in section and the formation of a mechanical couple to rotate them is difficult or impossible.

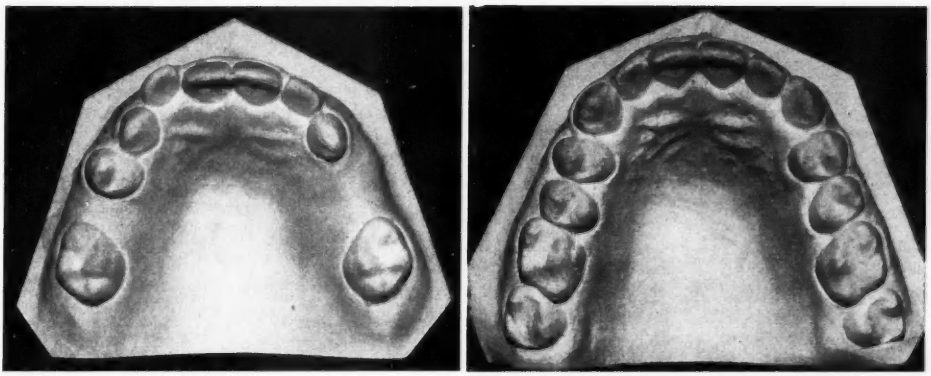
Another common tooth misplacement is the mesiolingual rotation of the upper first permanent molar, which considerably reduces the space required for the second premolar (*Fig.* 5 A). This tooth may be rotated distally by pressure on the mesial surface opposite to the mesiobuccal cusp (*Fig.* 6). Rotation takes place about the palatal root (*Fig.* 5 B).

The crowns of lower molars are not of a shape that facilitates rotation by means of pressure on any part of their mesial surfaces and the roots are of a shape and size that are resistant to rotation. These teeth are better rotated when necessary by means of fixed appliances.



A B

Fig. 4.—Appliance for rotation of upper first premolars distally. Note A, Anchorage is obtained from all the other teeth in the arch except the canines; B, The spring is applied with great accuracy to the mesial surface of the tooth opposite the lingual cusp.



A B

Fig. 5.—A, B, Distal rotation of left upper first permanent molar to facilitate eruption of second premolar.

ROOT MOVEMENT

This term refers to the tipping of apices deliberately in one direction or the other, a movement that is usually performed with most

of the fixed appliances, and there is little, if any, scope in this particular sphere for the effective use of removable appliances. At the same time if it is desired to tilt the roots

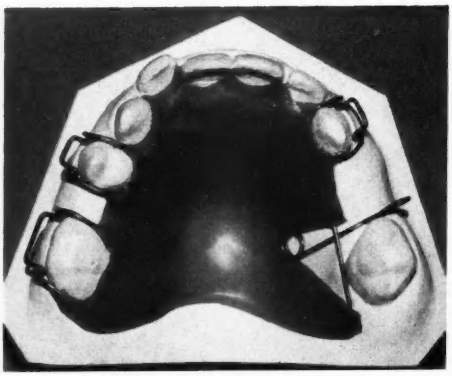


Fig. 6.—Appliance for distal rotation of upper first permanent molar. The spring, of 0·6-mm. wire, presses on the tooth opposite to the mesiobuccal cusp. Rotation takes place about the palatal root.

avoid the bite of the lower incisors and to get a point of application at the gingival margin as nearly as possible in the same plane as the incisal edge. In order to separate the points

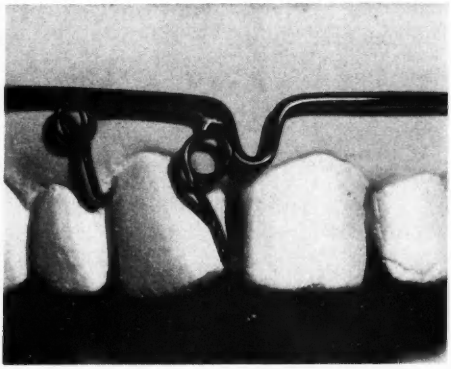


Fig. 7.—A *couple* is formed to tip the apex of 1 mesially. These springs are short and stiff, 0·6-mm. thick, and are applied with great accuracy as far apart as possible on the mesial and distal surfaces of the incisor. The ends of the springs are flattened and turned in to impinge squarely on the tooth.

Fig. 8.—Mesial root movement of upper right central incisor. Room was also made for the central incisors by extraction of first premolars.

of an upper incisor mesially or distally, this may be attempted with a fair prospect of success by applying equal and opposite pressures to the mesial and distal surfaces of the crown of the tooth near the incisal edge and at the cervical margin.

The appliance shown in *Fig.* 7 will produce these pressures. The tooth has to be approached from the labial side in order to of application of the pressures as widely as possible the lower spring should be applied as near as possible to the incisal edge and the upper spring may be applied actually below the gum margin by grinding the end of the spring flat and slipping it into the gingival trough. The springs are made of a fairly heavy wire, 0·6 mm. and coiled for resilience. They will, even so, have a short range of action, but

this will be no disadvantage in this instance because root movement is usually slow, so that quite long intervals can be allowed between adjustments of the springs (*Fig.* 8).

Root movement of other teeth in other directions is a haphazard and unreliable procedure with removable appliances and is not as a rule undertaken. The possibility of tipping upper incisors labially and lingually is one possibility that is open to exploration, but no results of such attempts are on record up to date.

The author is greatly indebted to Mr. D. R. McDougall, A.I.B.P., of the Photographic Department, Institute of Dental Surgery, London, for his care in the preparation of the illustrations for this paper.

BOOK REVIEWS

THE YEAR BOOK OF DENTISTRY (1954–5 Series). Edited by S. D. TYLMAN, D.D.S., M.S.; D. A. KEYS, D.D.S.; J. W. KNUTSON, D.D.S., Dr. P. H.; H. J. NOYES, D.D.S., M.D.; H. B. G. ROBINSON, D.D.S.; C. W. WALDREN, M.D., D.D.S. Pp. 464. Chicago: The Year Book Publishers Inc. London: Interscience Publishers Ltd. 45s.

FOR the busy practitioner this book provides, in a brief and easily readable form, enough information about research of the past year to enable him to keep pace with the advances of dental science. Thus he has in one volume a substitute for over forty publications. It would be a help if the Editors were to include a complete list of these publications from which abstracts are taken instead of relying solely on an individual footnote beneath each title.

The use of this book, however, should not be confined to the general practitioner. Dental research progresses now at such a rate and in so many fields that those engaged in full-time teaching and research are hard pressed to find time to read fully about their own particular subjects let alone all the others. For them the Year Book provides enough superficial knowledge of allied subjects to keep them intelligently up to date whilst stimulating their interest here and there to read the original articles. There is no other book which gives this service.

The articles abstracted are taken from journals received between September, 1953, and August, 1954. The abstracting and the quality of the photographs are of a very high order. The British literature gets fair though not overgenerous representation, and on the whole each subject is treated comprehensively.

J. R. G.

MAXILLOFACIAL ANATOMY. With Practical Applications. By HARRY H. SHAPIRO, D.M.D., Assistant Professor of Anatomy, College of Physicians and Surgeons, Columbia University, etc., 10 × $6\frac{3}{4}$ in. Pp. 392 + xiv, with 314 illustrations (46 in colour). 1954. Philadelphia: J. B. Lippincott Co. London: Pitman Medical Publishing Co., Ltd. 96s.

DR. SHAPIRO has attempted the very difficult task of planning a book dealing with the morphology and functional anatomy of the head and neck and the applied anatomy of these regions in order to satisfy the needs of students and practitioners of both medicine and dentistry. Developmental abnormalities and pathological lesions which may affect the various structures referred to are described in some detail. This is an ambitious scheme which has led to very superficial treatment of some aspects of the anatomy, a general lack of balance, and the inclusion of numerous irrelevancies. The heading *Sublingual Space* hardly seems the place to deal with tuberculous lesions of the oral mucosa or primary and secondary lesions of syphilis.

In the reviewer's opinion the author has attempted to attract the interest of too many types of readers. This book, which contains 314 illustrations, 46 of which are beautifully reproduced in colour, will find little favour with undergraduate and postgraduate students in this country.

R. F.

A PRACTICAL HINT IN DENTURE PROCESSING

THE majority of technicians use the "reverse or falling-heat method" for plastic curing, and whilst it is an excellent time-saving method for normal usage it fails to prevent porosity where a great thickness of material is used in cases of marked alveolar absorption. It is possible to demonstrate lower dentures showing a cross-section of $\frac{5}{8} \times \frac{3}{8}$ in. of material beneath the necks of the teeth over all the arch and unless some special method in preparing the denture is used porosity will be marked.

A method is described which permits the use of the "reverse" process and at the same time obviates the danger of porosity by utilizing the "flash" from the first pressing.

The dough is prepared, packed into the flask, covered with cellophane, and then pressed in the usual manner and according to the manufacturer's instructions. The excess material, or "flash", expressed from the sides of the flask is collected, put on one side, and subjected to as little contamination as possible. After opening the flask, recoating the model with separating solution and removing the cellophane from the denture, the excess material in the flask is trimmed away. The excess material or flash which was expressed from the sides of the flask and saved, is laid evenly over the inverted lower denture and the flask is finally closed and pressed. It will be observed that only about one-third of the extra material will be exuded on the second closure, thus indicating an increased density of the material.

It should be noted that the excess material used in this method has been under pressure and it is emphasized that this is used in preference to any "dough" left over from the original mix. The use of the latter will not be effective as it will not increase the density of the denture base to the same degree as using material already subjected to pressure.

In a large number of cases treated in this manner there has been none in which a model has been broken or where any alteration in the position of the teeth has been observed. The method can be applied to full upper dentures in which are included "plumpers".

J. WILLMOTT.

SOCIETY NOTES

DENTAL IMPLANT SOCIETY

ON April 13 an Extraordinary General Meeting was held at the Royal Society of Medicine. Professor Luigi Marziani, D.D.S., M.D., presented a paper and colour film on "One-stage Subperiosteal Tantalum Implants". The meeting was attended by nearly two hundred members of the profession, who gave an enthusiastic ovation to Professor Marziani at the end of his address. Numerous questions and a lively discussion ensued.

Professor Marziani's paper covered in detail the entire field of dental implants, including the aspects of engineering, metallurgy, physiology, surgery, histology, pathology, biology, and dynamics. Professor Marziani stressed the fact that successful implant dentures are functional stimulators, thus preventing bone absorption under the metal structure. Implants must be designed on sound engineering lines, so that stresses and strains set up in the implant are equal throughout its length and breadth. Similarly, pressure applied to the underlying bone must be evenly distributed.

The film clearly showed all the stages of the laboratory technique for fabricating the implants. The operation for insertion of implants was depicted, in addition to several close-ups of completed cases. The X-ray photographs and pathological slides showed healthy bone under the implants and healthy gingival troughs of normal histological structure around the abutments in interventions carried out $4\frac{1}{2}$ years ago.

In reply to questions, Professor Marziani said that he had completed nineteen implants, all of which were successful.

The English translation of Professor Marziani's paper was most ably read by Mr. Peter Felix (Hon. Treasurer). Before calling upon Dr. Pietro Pavesi to propose a vote of thanks to Professor Marziani, Mr. Boris Trainin, the Chairman, announced that several patients, with completed implants of chrome-cobalt alloy in situ, could be examined at the Society's headquarters the following afternoon. The guest speaker, members, and guests were invited to view them.

Copies of Professor Marziani's paper are obtainable from the Secretary, price 2s. 6d.

FEDERATION DENTAIRE INTERNATIONALE

News Letter No. 10 (March, 1955) contains information about the Forty-third Annual Meeting, Denmark, August 14–20, 1955, and includes the provisional programme.

It also contains information about the Second Panhellenic Odonto-stomatological Congress, Athens, September 25–30, 1955, and the twelfth International Dental Congress, Rome, September 7–14, 1957.

LONG TERM RESULTS OF ORTHODONTIC TREATMENT*

By **K. E. PRINGLE**, F.D.S. R.C.S. (Eng.), D.Orth. R.C.S. (Eng.)

MEMBERS of this Society have had the privilege since the first Monday of January, 1946, year by year and almost month by month, of taking part in a revolution in thought on orthodontic matters. Rix, Whillis, Ballard, Gwynne Evans, Hovell, Tulley, Nicol, Walther, and others have each made important contributions. I am sure that all the pioneers would admit that they have occasionally been at fault, in one way or another, but all have shown the same general understanding of the orthodontic problem.

Gradually, too, it has been possible to correlate the primarily English work on oromuscular behaviour with that on the skeletal development of the jaws based on cephalometric radiographs the main development in which has come from the United States. Ultimately jaw development and relations and the pressure resulting from oromuscular behaviour, particularly during swallowing, hold a very important place among the main general conditions determining the position of the teeth. Also, when we think that we can improve the situation, it is very largely jaw development and relations and the pressure resulting from oromuscular behaviour during swallowing which decides whether we can in fact do so permanently.

We must not forget mastication and the many other factors involved in one combination or another in producing a malocclusion, but speaking in a general sense I think that most of you will agree that what I have said is correct. I know there are those who remain not quite convinced. For me there were never these doubts and difficulties.

I knew by 1939 that there were at work in many orthodontic cases factors which I did not understand and I still had many questions unanswered. Then in 1944, or even earlier, Mr. Rix mentioned to me in the Children's Department at Guy's that he was watching and checking the way his patients swallowed and that some of them did so with their teeth apart. Immediately a whole series of questions was answered, but not all. As time passed more contributions were made to these studies and each of those I have mentioned has focused attention on at least one aspect of the problem and has helped me to understand something which I had not hitherto understood. With the common understanding which has arisen among us it is becoming increasingly difficult to say just who said "what" first. Having no claims to original thought myself, I can only refer you to all the Transactions of the Society since 1946 and make specific references where possible.

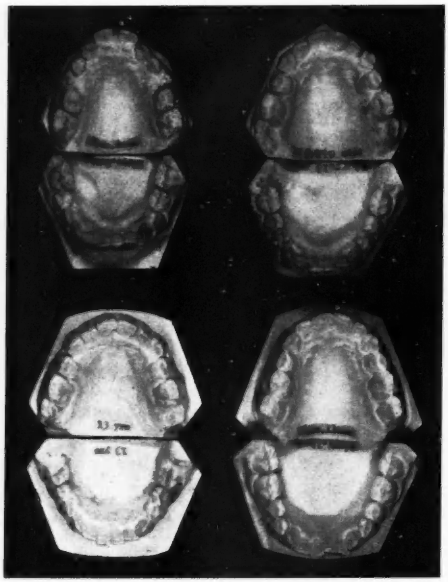
I said that there were those who are still not entirely convinced about this revolution in orthodontic thought. Perhaps this is because thought has sometimes been ahead of evidence and on occasions, too, the evidence, when it has been produced, has proved an earlier conception to be an overstatement. Again every piece of so-called scientific research based on the use of a new piece of apparatus, while perhaps helping towards a general understanding of a problem, must necessarily introduce errors leading to misunderstanding. Thus up to a point we are right to maintain a critical attitude towards any new theories or conceptions, particularly when they are put forward without much or any evidence.

My view is that the time for advancing new theories and concepts has now passed and as far as relating malocclusion to jaw development and relations and oromuscular behaviour is concerned, the next period, which will take a number of years, must be occupied here with production of evidence. We are entering a period of consolidation.

The evidence I am bringing forward to-night is simple. It consists of an analysis of ten cases. All but two of the patients had treatment at a time before 1946. So oromuscular

* Presidential Address given at the meeting, January 10, 1955, of the British Society for the Study of Orthodontics.

behaviour as a factor was barely considered when treatment commenced. A number of the errors and their results in the hope that others may avoid them.



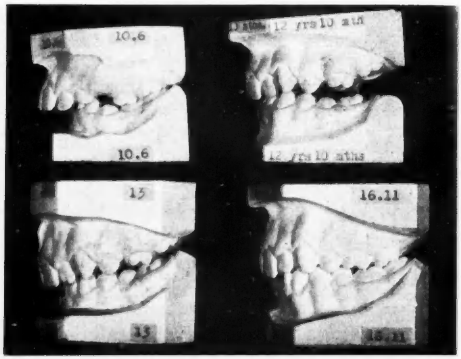


Fig. 1.—*Case* 1, treated by extraction of $\frac{5}{5}$ and monobloc.

models being ten to twenty years old, have had to be duplicated, and if we have made any

A young orthodontist does not have to bother much when he is treating a Class II, Division 1 case about what will happen after he has finished his skilled treatment, but a middle-aged orthodontist occasionally watches what were his best results at 12 years of age gradually changing into mediocre ones.

Three cases are presented which focused my attention on this:—

Case 1 (*Fig.* 1).—This is a case from my practice. For various reasons the patient's attendances were poor and I was glad to obtain by the aid of the extraction of $\frac{5}{5}$ and a monobloc this result at 13 years, particularly after a halfway stage, which showed me for the first time what can happen to the bite if a monobloc is worn for a long period without trimming (age 12.10). After the boy had disappeared with his untrimmed monobloc for several months he returned without one back tooth capable of meeting its opponent. As soon as his front teeth were straight and his monobloc removed the boy disappeared again, and thinking that all was reasonably well I was quite happy to let him do so. I simply had not appreciated the signs of future collapse in the lower dental arch. Some years later his dental surgeon referred him to me again

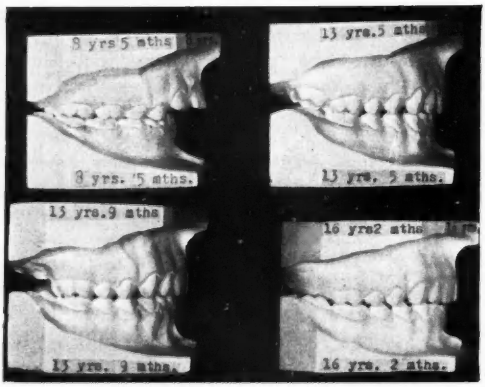


Fig. 2.—*Case* 2, treated by monobloc and extraction of $\frac{7}{7}$.

minor errors in angulation of incisor teeth we offer our apologies. As we go through the cases I shall comment on various technical

because of the crowding of the lower incisors (age 16.11). That was about three years ago. Even as recently as that I thought it was the third molars which were at fault more than anything else.

During treatment the measurement between the upper first molars and the upper central incisors decreased by 6–7 mm. Since the end of treatment to the most recent models (about 3½ years) there has been a continued decrease of 2–3 mm. The lower arch in the same region has also decreased by 2 mm.

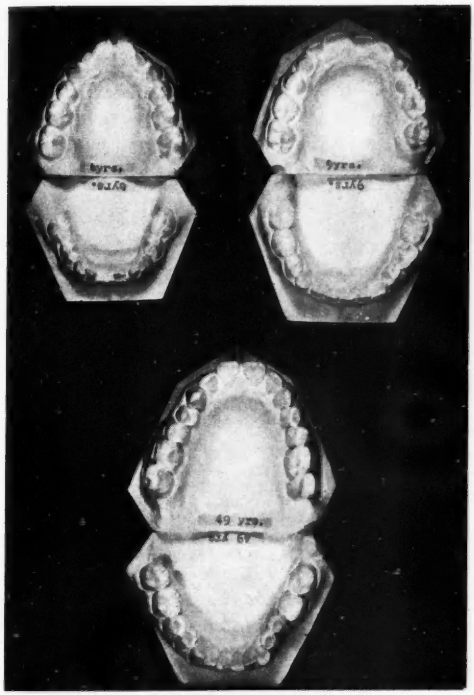
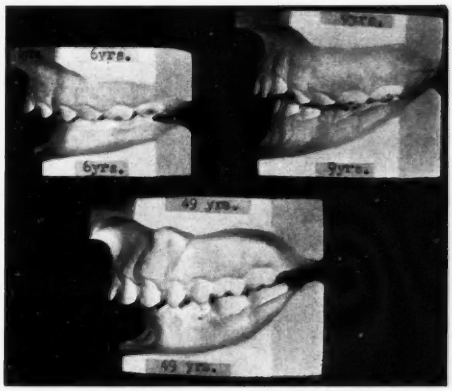
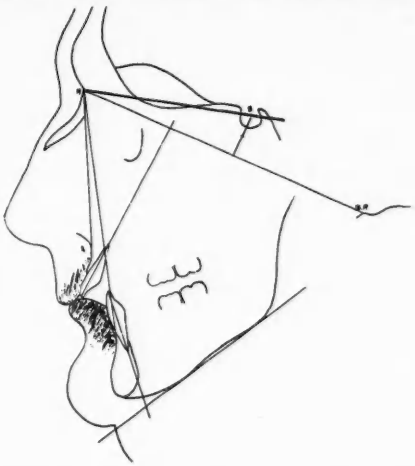


Fig. 3.—*Case* 3, father of *Case* 2. Note lip seal despite some relapse of upper incisors.

Case 2 (*Fig.* 2).—Some years ago a young girl was referred to me at my practice for orthodontic treatment (age 8.5). There had been thumb-sucking and she certainly lisped. I suspected that she swallowed with teeth apart and the tongue advancing over the lower incisors, to seal with an indrawn lower lip. The child was very intelligent and the parents were most helpful. The father told me that he had been treated by Mr. Chapman, who had obtained an excellent result for him, but that when he was about twenty years old the teeth had started to move back to their old positions. I did not examine his mouth at that





time but made a mental note that he lisped and that he had a Class II, Division 1 occlusion with a definitely postnormal mandible (Ballard skeletal 2) and that he probably swallowed with teeth apart and the tongue advanced to seal with an indrawn lower lip. (I am using the skeletal classification and

Angle's classification rather loosely throughout as a kind of orthodontic shorthand.)

The child's treatment, which was by monobloc, went well except that the occlusion was perhaps a third of a unit out on the right side. As a precaution I had 7| extracted (age 13.5). However when we left off the monobloc (age 13.9) she came back saying that her teeth were "going back". By the evidence of models this was not true, as her occlusion from being not quite "normal" had settled into being "normal" all round the mouth (age 16.2). She still lisps and her tongue is still in evidence, but the lower lip is brought well up the labial side of the upper incisors when she swallows. I am still keeping her under observation with some interest. At the moment |1 is a trifle more proclined than 1| and I am now recommending extraction of |7.

Case 3 (*Fig.* 3) (The father of *Case* 2).—After asking Mr. Chapman's permission, I recently had the opportunity to examine the father. By great good fortune Mr. Chapman was able to lend me models of the boy before treatment at 6 years and on August 1, 1914, at 9 years of age. One can see that at that time his treatment with intermaxillary traction was proceeding well. One can see from the first models of the temporary dentition the severity of the Class II, Division 1 condition. One can see also the retroclination of 1|1 as they erupt. I am sure it was as difficult a case of its kind as one could find.

We have no history of the case after 9 years of age, but the treatment was clearly satisfactory to the parents and the boy, until he was about 20 years old. Then gradually and inexorably the adverse combination of poor skeletal relations and the abnormal oromuscular behaviour that went with them took their toll. The patient is now 49; $\frac{8|8}{8|8}$ were extracted at 35 years of age. My lateral radiograph taken without a craniostat gives an idea of the way he seals in the rest position. The lips seal at the level of the tip of the upper incisors. The lower lip is pulled in hard at the base of the lower incisors and is then curved forward to meet the upper lip. My original impression that he swallows with teeth apart and the tongue advanced over the lower incisors to touch the lower lip seems to be correct. An interesting feature is that when the patient is asked to bite he is still uncertain whether to bite into a more forward position than is strictly correct.

The following measurements are of interest. In the last forty years (ages 9–49) the distance between the upper first molars and the upper incisors has slightly decreased. The same measurements in the lower arch have decreased by 4–5 mm. It is the lower arch which has collapsed, and I think the false forward posture of the lower jaw. If the upper teeth have advanced they have done so as a whole, not simply the incisors.

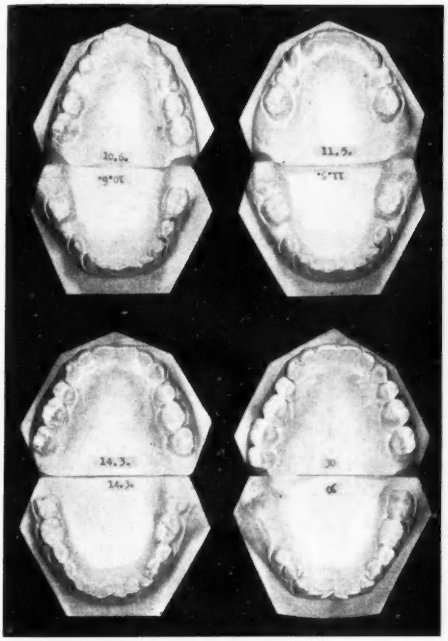
These then are the kind of problems that come as one gets older and yet if one looks at even only the next seven cases, who were all who returned to us, when we wrote to quite a few, we shall see that oromuscular behaviour can act as a factor stabilizing a result, or as a factor operating against stability in either or in both arches.

Case 4 (*Fig.* 4).—This is a case from the practice. When I was a dental student I knew the boy's parents. The father was skeletal II and Angle's Class II, Division 1, with, I should certainly say, associated abnormal swallowing habits. I do not remember whether he sealed his lips completely, but my recollection is of two front teeth showing rather a lot.

The boy used to sit in his push-chair sucking his thumb with great vigour. As a young suburban practitioner I took on his treatment with some trepidation (age 10.6). However, with the aid of extraction of 4|4 and intramaxillary traction with Visick's appliance, carrying cleats over 1|1, an excellent result was obtained in a very short time (age 11.5).

I thought the result might well have relapsed, for I am sure that originally there cannot have been what we would call normal deglutition or a normal lip seal. I was quite wrong, for when I saw him a few months ago (age 30) I found that his incisors were practically exactly the same as when treatment finished (age 14.3), but with rather a deep incisor overlap (overbite). He has grown to an immense height.

He lost one or two teeth in the Army, but otherwise his oral condition is good, with no more than the usual amount of caries. He gives the outward appearance of a mild skeletal II, with Class II, Division 2 type of



mouth, and when he swallows he seals his lips by bringing his lower lip well up the labial side of his upper incisors to seal with a shortish upper lip. I think this must have been a stabilizing factor. Nicol in his recent communication to this Society focused our attention on this question of the height up the labial side of the incisors at which the seal takes place. The crowns of the upper incisors and first molars moved about 12 mm. nearer to each other in 11 months' treatment. Since then the distances between these teeth have hardly changed.

The measurement $\underline{6}|$ to $|\underline{6}$ narrowed by 4 mm. during my treatment with intramaxillary traction, but after this they recovered themselves and now the measurement is a trifle more than at 10.6 years. Between ages 10.6 and 14.3 the measurement between $|\underline{3}$ and $|\underline{6}$ increased without help by 4 mm. to accommodate $|\underline{5}$, but this measurement has lessened by a half this amount since then, so that $|\underline{45}$ have buckled. $\underline{1}|$ has also rotated.

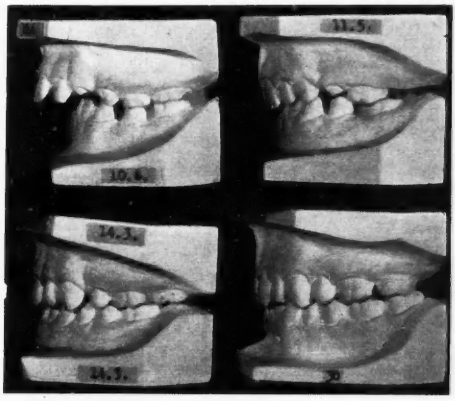


Fig. 4.—*Case* 4, treated by extraction of $\underline{4}|\underline{4}$ and intermaxillary traction.

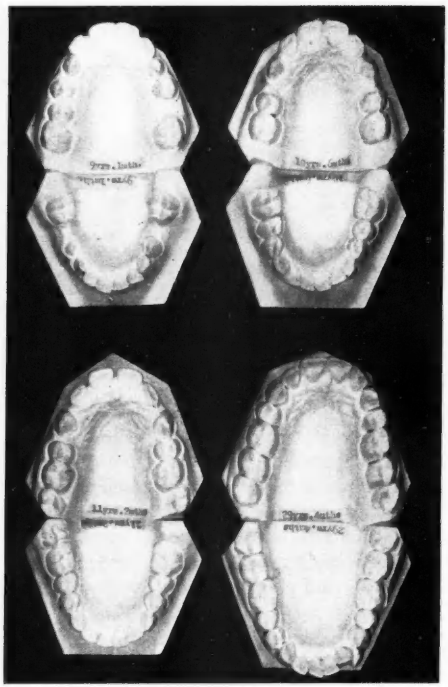
This rotation of lower incisors can of course be seen as a normal phenomenon.

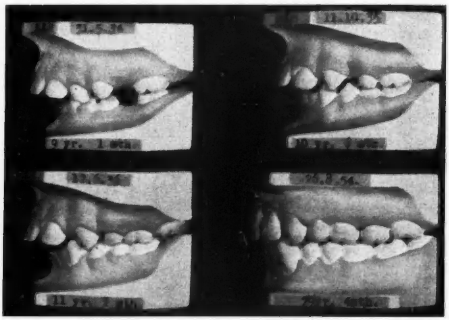
As we continue to examine our cases this evening I think it will become clear that the degree to which the lower lip comes up to compensate for a short upper lip is very important. Among the medical students at Guy's is a very charming and always smiling young lady, a mild skeletal II, with $\frac{6|6}{6|6}$ extracted and with upper and lower incisors retroclined with a deep incisor overlap (overbite). When the upper lip is at rest one can see all the labial sides of the crowns of the upper incisors and a substantial amount of the gum above these teeth. Yet when the young lady swallows she brings the lower lip up to seal with the upper at a level higher than the necks of the upper incisors.

At this point I should say that I have found it more difficult with adults to establish whether they have a "tooth apart swallow" than is the case with a child, who is for the first time asked to swallow. We all know the difficulty of deciding anything about a child's

swallowing habits when several people have tried to find out before us. The adult on being asked to swallow seemingly has to think "Why does he ask me to swallow?" and this intellectual interference interrupts what should be a natural action.

Case 5 (*Fig.* 5).—My next patient is one whose upper incisors were large and extremely proclined. As you will see, he was a very nice boy. Although he had a reasonably good lower jaw and a very good lower dental arch, there was not the slightest possibility of a lip seal





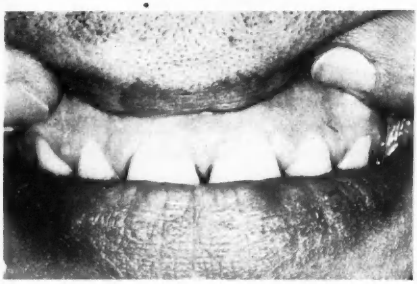


Fig. 5.—*Case* 5, treated by extraction of $\frac{4}{4}$, retraction of $\frac{3}{3}$, followed by retraction of $\frac{21}{12}$.

before orthodontic treatment started. When he began his treatment I knew nothing of oromuscular behaviour as an aetiological factor, so that I can only guess what happened when he swallowed, but it could be that he was one of those extreme cases described by Rix who swallow with cheek teeth together or nearly so and obtain their main anterior seal when the lower lip is "trapped" between the upper and lower incisors, the upper lip remaining high and taking no active part in the seal. As I say, this is simply a guess on my part. The treatment was:—

1. Extract $\frac{4}{4}$.
2. Retract $\underline{3|3}$ while using an upper bite plate.
3. Retract $\underline{21|12}$ with saddle upper plate and labial bow.
4. Retention.

The first models (age 9.1) show the original condition. The second models (age 10.6) the extraction of $\frac{4}{4}$. The third models (age 11.2) show the canines retracted and, however it occurred, the raising of the bite anteriorly. The models at completion were I am afraid lost, but the result was a good one as I remember it. Some 18 years later (age 29.4), and much to my surprise, not only have the upper incisors remained in their retracted position but the lower incisors and canine regions have to a considerable extent collapsed. The overbite is now fairly deep. The young man now seals his lips at rest and swallows with a powerful lip seal, with his lower lip everted to give an extra pressure. The lower lip comes well up the upper incisors. Someone may ask whether the man now seals his lips through a conscious effort or through maturation. I do not know the answer to this question, but I watched for about an hour recently and his lips were sealed at rest.

Mr. Tulley's electromyographic report says: "No marked masseteric contraction during swallowing, indicative of a 'tooth apart swallow'. At rest the lips show active contraction when sealed and during swallowing more than usual lip activity is recorded."

I note that during treatment with the bite plane the lower occlusal plane flattened out, since then the curve has returned. I used to teach that a deep incisor overlap (overbite) at the end of treatment was an adverse factor for stability of the upper incisors. Clearly it need not necessarily be so.

Case 6 (*Fig.* 6).—Mrs. S., the next patient, sucked her thumb and came to Guy's at an early age (age 6.6), showing a typical Class II, Division 1 with an anterior open-bite abnormality in the deciduous dentition. There was a flat occlusal plane. We waited until the permanent incisors were through (age 8·5), and the treatment was then as follows, using fixed upper labial and lower lingual appliances:—

1. Proclination of $\underline{21|12}$ to give a better alinement of these teeth and provide premolar space.
2. Extraction of $\frac{4}{4}$.
3. Retraction of upper incisors with intermaxillary traction.

At the end of treatment (age 12.2) everyone was happy with the result. Nine years later (age 21.9) the upper and lower incisors have kept good mutual relations. The incisor overlap (overbite) is deep and the patient gives the appearance of skeletal II, and her models resemble an Angles Class II, Division 2 type. Her lips are sealed at rest and when she swallows the lower lip seals well up the labial side of the upper incisors.

Mr. Tulley's electromyographic report says: "No marked contraction of masseter during basic swallowing, but in swallowing after chewing biscuit there was a marked masseteric contraction indicative of a tooth together swallow. Lip activity only slight compared with Case 7." (*Fig.* 8 A, B.)

The measurements show that from the beginning of treatment to the end there was an increase in the distance between $\overline{1}$ and $\overline{6}$ of 4–5 mm. From the end of treatment until now there has been a decrease in the same measurements of 6 mm. That is to say the measurements are rather less now than they were before we started the treatment of the lower dental arch. Some recent extractions may have helped this collapse or could one say double retroclination of the incisors?

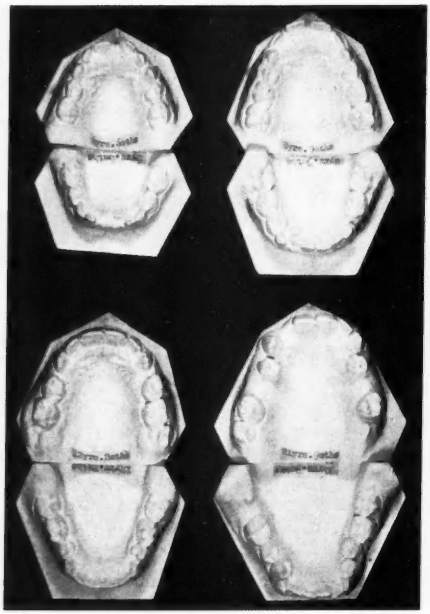
The lateral profile radiograph is interesting, for the lower incisors are still at an angle of

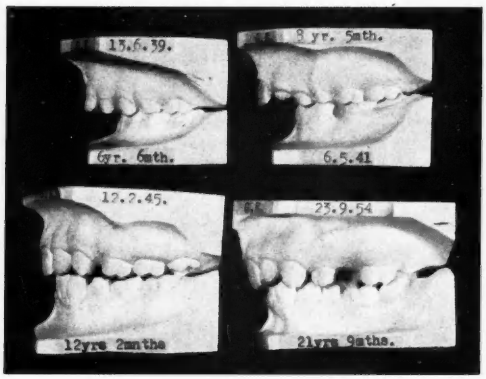
more than 90° to the mandibular plane. I feel that I still do not understand all that has happened in this case.

Case 7 (*Fig.* 7).—Mrs. C., as a girl (age 10.6) showed a teeth-apart swallow of the type where the tongue advances to seal with an indrawn lower lip everted but behind the upper incisors—a familiar picture. Treatment, which was very hard work, was by:—

1. A little upper expansion.
2. Extraction of $\frac{4|4}{}$.
3. Intermaxillary traction with fixed appliances (age 13.11 during this stage).
4. Quite a long retention (age up to 16.8).

Six years after treatment (age 22.11) a skeletal II relationship remains and she still swallows with teeth apart and the tongue advanced to meet an indrawn everted lower lip. At this moment, however, when this anterior seal occurs the upper incisors are trapped in the lower lip at, so to say, a half-way point, so that part of the lip is in front of the upper incisors and a part behind. She is





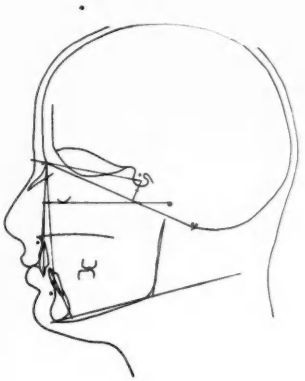
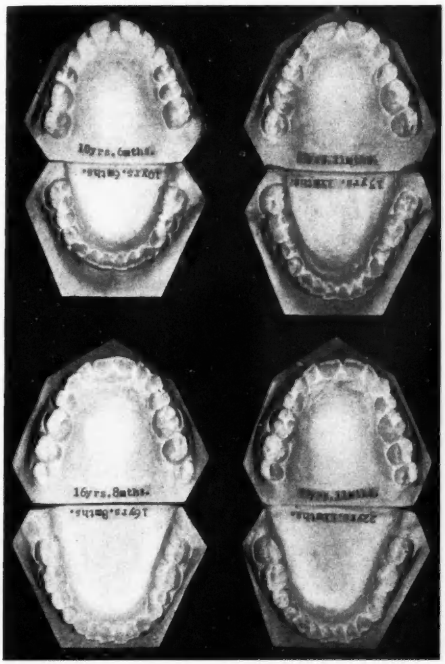


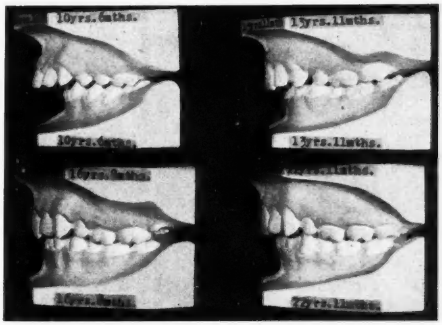
Fig. 6.—*Case* 6, treated by extraction of $\frac{4|4}{}$ and intermaxillary traction. (Compare lip position with *Fig.* 7.)

the only one of my cases who complains that the upper incisors are relapsing, i.e., becoming proclined again.

The measurements since the completion of treatment are interesting because the lower measurements show no change, while there has been spread of the upper incisors. The space between $\underline{1|1}$ has increased. This of course should be compared with the earlier cases, where the powerful lip seal is associated with a lessening of the lower measurements. This patient can seal her lips at rest, but I think that in her case this is definitely the result of voluntary effort.



The lateral tracing is perhaps as one might expect, but the electromyographic record is of interest in that this patient shows more than any of the others a marked lip activity during swallowing. Mr. Tulley's electromyographic report shows the value of having a clinician standing by the machine. He says: "There was no marked masseteric contraction in the basic or post-masticatory swallow,



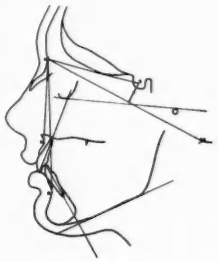


Fig. 7.—Case 7, treated by extraction of $\underline{4|4}$ followed by intermaxillary traction.

but there was evidence of considerable lip activity, particularly of the lower lip. A similar myograph has been seen in other partially relapsed Class II, Division 1 cases." (*Fig.* 8 A, B.)

Case 8 (*Fig.* 9).—In the next case there was no thumb-sucking. The patient was clinically a mild skeletal II, Angle's Class II, Division 1 (age 9.1). Treatment was by intermaxillary traction with fixed appliances following a little upper

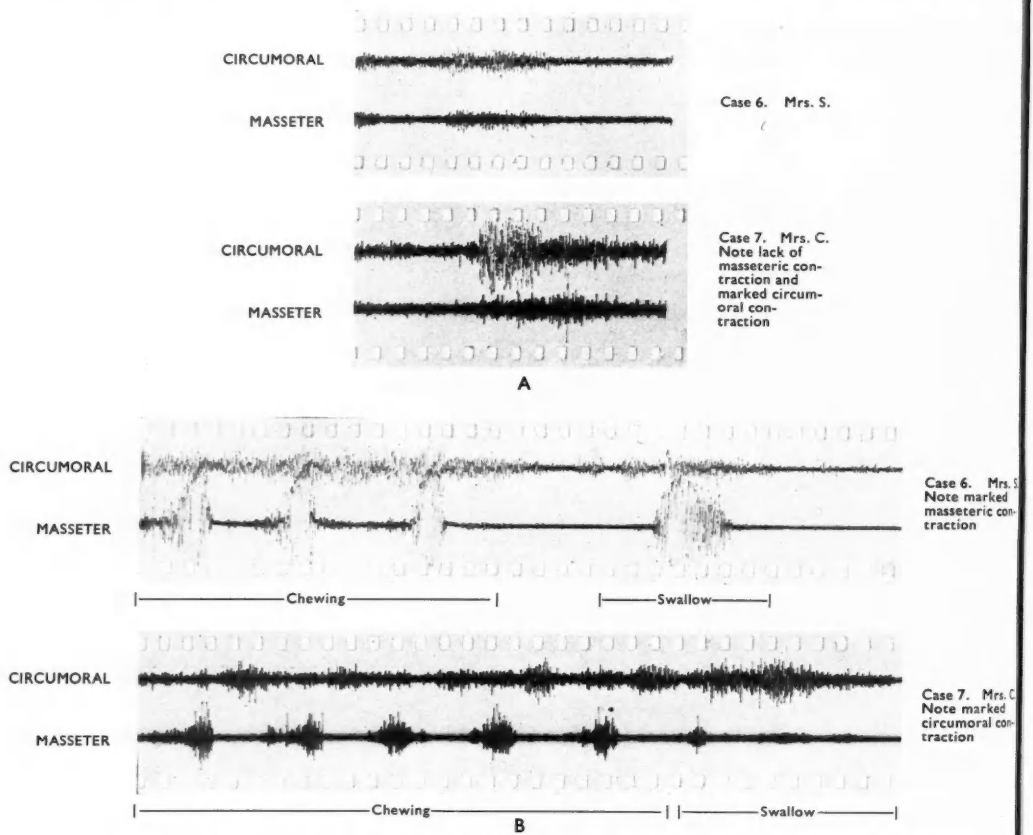


Fig. 8.—Electromyographic tracings comparing the oro-muscular behaviour in *Cases* 6 and 7. A, During the basic swallow; B, During swallowing after chewing biscuit.

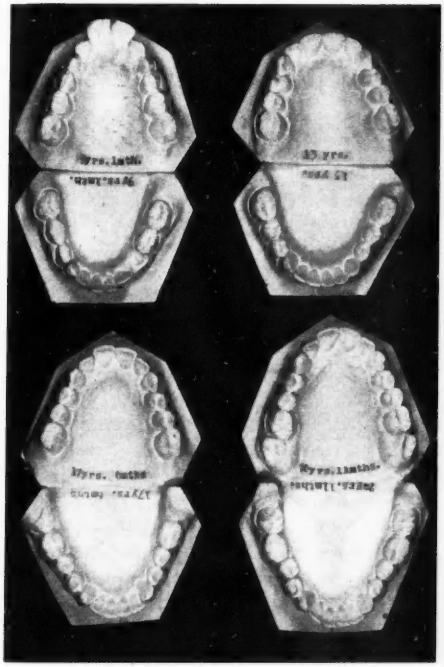
The electromyograph as yet shows only the degree of lip activity during swallowing and not whether this lip activity is in our favour or not. This latter requires a clinician. There seems to be the possibility of further research here as to the amount of pressure exerted by the lips on the incisor teeth and the amount of pressure applied to the different parts of these teeth.

expansion. We must have used a lower bow that was not passive, for we produced labio-occlusion of $\overline{6|6}$. Finally we extracted $\frac{7|7}{7|7}$ (age 13.0).

Now at 20.11 years his lips are sealed at rest. He swallows with his lower lip a short way up his upper incisors. The models show very little change in position and relations of teeth

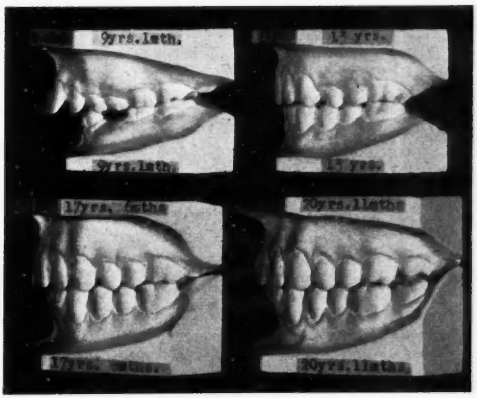
since treatment finished. I think he is one of those patients we all hope for whose treatment goes well with almost any form of appliance therapy.

His lateral radiograph is as one would expect.



Case 9 (*Fig.* 10).—My last Class II, Division 1 patient shows how a lip seal sometimes becomes established even with little treatment. His only treatment was the extraction of $\frac{4|3}{}$ (age 12.11) and a little alinement of his upper incisors in 1939 (age 13.4). In spite of a considerable number of extractions in both arches the incisor teeth have held remarkably to their relations (age 28.4).

A photograph of him as a boy showed him smiling, with his upper front teeth well to the fore. Now his lips are sealed at rest and during swallowing. This is quite a noticeable feature of his face. However, he still swallows with teeth apart and tongue brought forward, making contact with the lower lip. His lateral



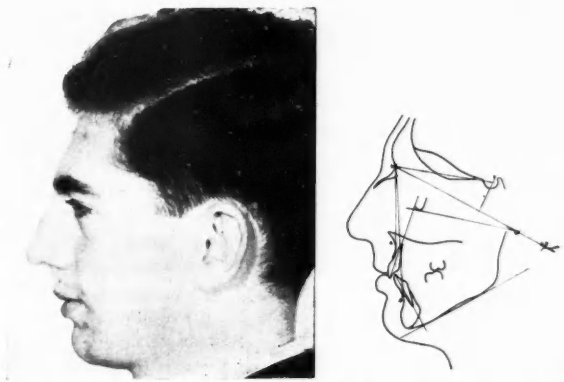


Fig. 9.—*Case* 8, treated by intermaxillary traction followed by extraction of $\frac{7|7}{7|7}$.

profile tracings are not remarkable except for perhaps a rather high Frankfort mandibular plane angle.

His electromyographic report says: "No outstanding aspects of this electromyograph. No well-defined masseteric contractions; which indicates a 'tooth apart' swallow. More than average lip activity."

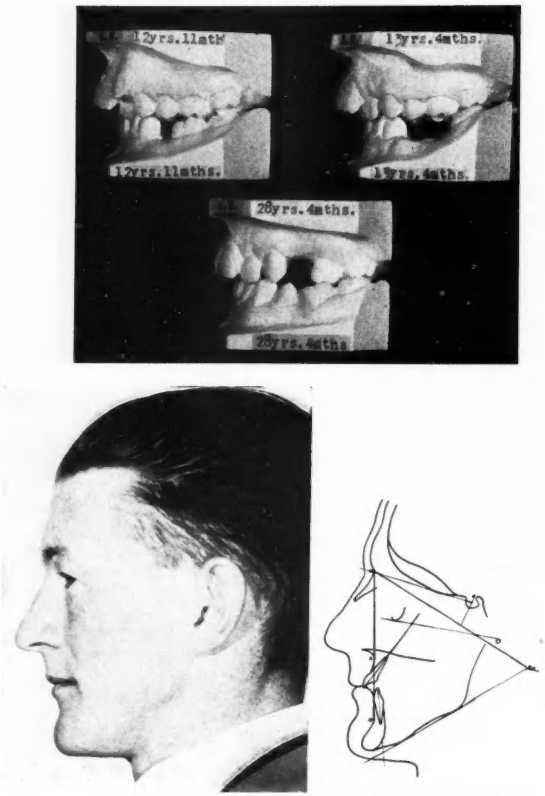


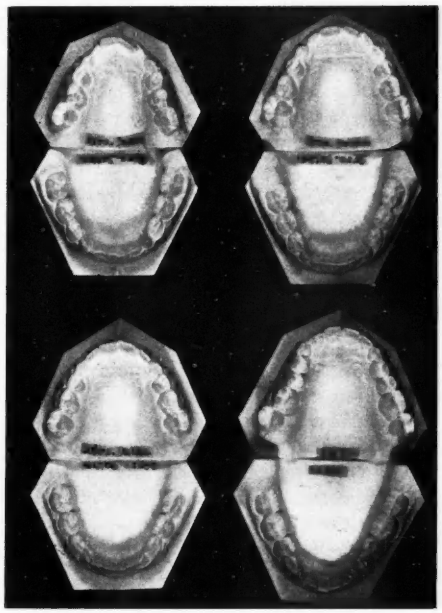
Fig. 10.—*Case* 9. No appliances; treated by extraction of $\frac{4}{4}$.

Case 10 (*Fig.* 11).—My last case is from my early days in practice. I made notes that the patient who was 8 years 3 months old when I first saw her, was pale, quiet, and shy, but observant. Her mother had lingual occlusion of the upper molars and canines, but her incisors were in normal relations. Her sister had normal occlusion. I also noted the slight imbrication of lower incisors with an otherwise normal arch. Like her mother, she had a very narrow, high-vaulted palate. Except for [illegible] all the upper teeth were in linguo-occlusion. I classified the case as Angle Class I, but I am sure that to-day I would have said there was a tendency to a skeletal III, and that I would have said that the mother was skeletal III also, although she also may have shown an Angle Class I malocclusion. Though of course in 1933 I did not look for such a thing, I am also certain that the child was one of those who swallow with the tongue placed ("thrust" is the wrong word) between the cheek teeth.

Treatment was simple and consisted in advancing the upper incisors over the bite and expanding the upper arch with expansion plates (age 9.3). Three appliances were required, with twenty-eight visits during active treatment. After this there were seven visits for observation (age 10.9). My last note is one year after my last models and reads "Premolars erupting well".

I was very happy to have the opportunity of seeing this patient again recently because, as far as I know, very little has been published about this type of case compared with Class II, Division 1 cases. The patient is now 29 years of age. $\overline{8|8}$ show disto-angular impaction. In spite of the skeletal III tendency, all the upper teeth occlude normally except $6|$. In this area after the expansion there had been a gain of 7 mm. Since treatment ceased 6 mm. of this have been lost. There has been considerable diminution also (3–5 mm.) in the measurements between the first molars and the incisors in both arches.

It was difficult to get the patient to swallow naturally, but as far as I can tell she swallows with cheek teeth slightly apart and the tongue



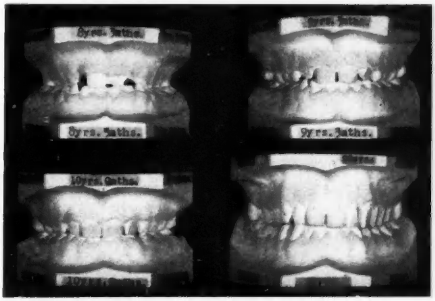


Fig. 11.—*Case* 10, Treated by upper expansion and plate to push $\frac{21}{12}$ over the bite.

placed rather forward between upper and lower premolar teeth. The lips of course are firmly sealed.

Before concluding, I would like to thank the patients, now adult, who returned for examination. In every case I was lucky, for they had all been keen and co-operative during treatment.

Acknowledgements.—My thanks are due to Mr. Bocquet Bull and Mr. Rix, under whom some of these cases were treated. I must also thank the Dental Council of Guy's Hospital Dental School for the facilities provided for my illustrations; Miss Whitely and Mrs. Pearson for their photography; Mr. W. Colwell for excellent work on models; Mrs. Rawlins for tracings; and of course Mr. Tulley for his electromyographic reports. Lastly, I must again thank Mr. Chapman for letting me show his case. Mr. Chapman's search for truth has been one of the foundations of this Society, and the fact that he was entirely agreeable to my showing his case is just one more example of the way we should all proceed.

REFERENCES

(Reference should be made to all issues of the *Transactions of the British Society for the Study of Orthodontics*, from 1946 onwards.)

BALLARD, C. F. (1948), "Upper Respiratory Musculature and Orthodontics", *Dent. Rec.*, **68**, 1.

— — (1948), "Some Basis for Aetiology and Diagnosis in Orthodontics", *Ibid.*, **68**, 133.

— — (1951), "Recent Work in North America as it affects Orthodontic Diagnosis and Treatment", *Ibid.*, **71**, 85.

— — (1953), "Some Cases to illustrate Relationship between Aetiology, Prognosis, and Treatment Planning in Orthodontics", *Ibid.*, **73**, 669.

GWYNNE-EVANS, E. (1948), "Upper Respiratory Musculature and Orthodontics", *Ibid.*, **68**, 5.

— — (1951), "The Organisation of the Oro-facial Structures in relation to Breathing and Feeding", *Brit. dent. J.*, **91**, 135.

— — (1952), "Analysis of Oro-facial Structures with Special Reference to Muscle Behaviour and Dental Alignment", *J. Speech*, **16**, 1.

HOVELL, J. H. (1950), "Aetiological Approach to Orthodontic Diagnosis", *Dent. Rec.*, **70**, 222.

— — (1949), "Working Model to aid in Teaching Orthodontic Diagnosis", *Ibid.*, **69**, 283.

NICOL, W. A. (1954), "Morphology of Lips in relation to Incisor Teeth", *Dent. Practit.*, **4**, 220.

PRINGLE, K.E. (1946), "Variations in Response", *Dent. Rec.*, **66**, 187.

— — (1950), "Modern Trends in Orthodontic Treatment in Children", *Med. Pr.*, **224**, No. 81.

RIX, R. E. (1946), "Deglutition and the Teeth", *Dent. Rec.*, **66**, 103.

— — (1953), "Some Observations upon the Environment of the Incisors", *Ibid.*, **73**, 427.

TULLEY, W. J. (1952), "Applied Anatomy of Orthodontics", *Ibid.*, **72**, 13.

— — (1952), "Methods of Recording Patterns of Behaviour of Oro-facial Muscles using the Electromyograph", *Ibid.*, **73**, 741.

— — (1954), "Prognosis and Treatment Planning in Orthodontics", *Brit. dent. J.*, **97**, 135.

WALTHER, D. P. (1953), "Some Cases to illustrate Relationship between Aetiology, Prognosis, and Treatment Planning in Orthodontics", *Dent. Rec.*, **73**, 676.

WHILLIS, J. W. (1946), "Movements of the Tongue in Deglutition", *Trans. B.S.S.O.* 121.

DISCUSSION

Mr. Norman Gray congratulated Mr. Pringle on his election as President of the Society and said that his Presidential Address would be of immense permanent value, as it contained carefully weighed evidence from Mr. Pringle's rich experience and drew attention to the focal point of good diagnosis.

The question of long-term end-results of orthodontic treatment was very important. The relating of oromuscular behaviour to the skeletal development of the jaws was one of the great key secrets to long-term success or failure. Adequate lip seal must always act as one of the main stabilizing factors, just as surely as inadequate sealing of the lips inevitably meant instability, relapse, and ultimate failure. Long-term results often depend on a thorough initial diagnosis; therefore very full case notes should be made, and, when they had been recorded with carefully articulated models and a detailed X-ray examination, they should be thoughtfully appraised and re-written, the malocclusion classified, and a report made on the X-ray findings. The final notes should include a written diagnosis and outline of treatment, together with the prognosis, largely based on the adequacy of the lips to retain the dental arch. He himself made a point of reading the X-ray report and the active treatment notes at nearly every visit.

Orthodontists should take a great interest in any deviation from normal breathing through clear nasal passages. Class II, Division 1 children often suffered from some nasal defect or had a persistent catarrhal condition with stuffy breathing. A large proportion of children under orthodontic treatment had bad respiratory habits completely unchecked. At his orthodontic clinic he had been able to obtain the help of physical training instructors from a training college, who gave the children exercises to encourage nasal breathing. They were also given lip and tongue exercises by being taught to repeat phrases such as "Peter Piper picked a peck of pickled peppers". The children were supervised, and they were marked for the successful performance of the exercises in their homes.

If he had had longer notice of the invitation to open the present discussion he could have collected and photographed a group of Class II, Division 1 cases that had remained in ideal occlusion over many years. He felt sure that every successful result would show not only an adequate cover of the upper incisors by the lower lip but also the establishment of good nasal respiration.

Miss L. M. Clinch congratulated the President on his very interesting address.

It would seem from the President's lecture that an abnormal swallow combined with a strong lip seal resulted in collapse of the lower incisors, whereas an abnormal swallow without a good lip seal resulted in collapse of the upper (but not the lower) incisors. In her experience the collapse of the lower incisors was very much the more common and was in fact one of the big problems in orthodontic treatment. It was very difficult to be sure that the lower incisors would be in good alinement ten years after all appliances had been removed, and cases which had good occlusion until 19 or 20 years of age showed some collapse of the incisors about that stage. Would the abnormal swallow not affect the occlusion sooner if it was solely responsible for this later collapse in untreated cases?

It was very interesting to see that the case shown by the President in which there had been no relapse at all, and in which the result had been excellent, was one of the two cases in which there had been no extractions. The relapse in the other cases might be partly due to the fact that the postnormal arch relationship had been treated by extractions in the upper arch and retraction of the upper incisors instead of by an attempt to correct the arch relationship.

Mr. J. H. Hovell said he thought the chief lesson to be learned from the President's address was that the most important thing in orthodontic treatment was the need for ultimate stability of the upper and lower incisor teeth, within muscle balance.

In the old days, when orthodontists did not know anything about skeletal pattern, they

had put the teeth into correct relationship with the lips and had obtained good results, which did not relapse very much. He thought that they should return to observing the soft-tissue behaviour and should avoid the mechanistic approach to orthodontics which was likely to arise from too great a consideration of skeletal patterning factors, with attempts to produce ideal relationships often unattainable or unstable.

Mr. H. Chapman congratulated the President on the excellence of his slides and results, particularly his long-term results.

With regard to the imbrication of the lower incisors, one of the cases which he had shown in a recent address had normal occlusion with good upper and lower incisor alinement until the age of 15 or 16 years, and then developed imbrication of the lower incisors without having had any orthodontic treatment. It seemed to him, therefore, that it was a natural phenomenon.

When the premolars had erupted into a space which was too small for them, he thought that might have been at the expense of the lower incisors, in which greater crowding was shown.

In one of the cases shown at the age of 29 years there was a remarkable degree of lower lip covering the upper incisors. If that was one of the cases in which the alveolar process and the upper arch anteriorly appeared to be of unusual length, that might be part explanation.

In the cases shown by the President there seemed to be an unusually large number in which the arch was long as compared with the width.

Mr. C. F. Ballard congratulated the President on his address and referred to the question of relapse. He said that if a study of soft-tissue behaviour indicated what was going to be the stable end-result orthodontists should not regard a case as a failure if, in the end-result, the incisors were not in the position which the text-books stated to be the ideal occlusion. If, for instance, an orthodontist saw a case with an overjet of half an inch and a reduction by only half that amount was all that would remain stable, that case should be regarded as a satisfactorily treated case in that position. Both time and money would be saved if orthodontists attempted to achieve only that which would be a stable end-result whether or not that was a normal occlusion.

A number of questions were asked during the discussion by Messrs D. F. Glass, J. E. Phillips, J. H. Gardiner, P. J. Holloway, and E. K. Breakspear.

The President thanked all those members who had taken part in the discussion (which he had enjoyed) and said that he would take presidential licence and not answer them formally.

On the motion of *Mr. S. G. McCallin*, a vote of thanks was accorded to the President for his address, and the meeting then terminated.

Dr. Robert V. Bradlaw to advise Indonesian Government on expanded programme of Dental Health Care

Dr. Robert V. Bradlaw, Dean of the Dental School and Professor of Oral Pathology at the University of Durham, is due to arrive in Djakarta on April 25 on a special short-term assignment with the World Health Organization in connexion with Indonesia's plan to expand her dental health services.

Dr. Bradlaw has gone at the invitation of the Indonesian Ministry of Health and will visit the University of Indonesia and the Dental Nurse Training School in Djakarta, as well as Airlangga and Gadja-Madah Universities for discussions with the respective dental faculties. Arrangements have also been made for him to visit Surabaja, Menado, Jogjakarta, and Bandung.

His programme will include particular reference to school dental services and the possibilities of further strengthening them. At the conclusion of his visit Dr. Bradlaw will submit recommendations for consideration by the Indonesian Ministry of Health in developing the country's expanded programme of dental health care.

Apart from the posts he occupies in the University of Durham, Dr. Bradlaw is Chairman of the Dental Advisory Committee to the Minister of Health as well as Consultant to the Royal Navy, the Ministry of National Insurance and Pensions, and the Ministry of Supply. He is a former Dean of the Faculty of Dental Surgery of the Royal College of Surgeons and Chairman of the Dental Education Advisory Council of the United Kingdom and Northern Ireland. Dr. Bradlaw is an Honorary Member of the Indian Dental Association and, on the invitation of the Government of India, has carried out assignments in that country similar to his present work in Indonesia.

MINISTRY OF HEALTH

N.H.S. GENERAL DENTAL SERVICES

Increase in Dentists' Remuneration from May 1, 1955

1. The Minister of Health has decided to increase the fees payable to dental practitioners for services provided under the General Dental Services.

2. It is intended that the increase in fees should be linked with a new Scale of Fees which will differ from the one now in operation not only in respect of the amount of the fees but also in respect of the list of items of treatment contained in the left hand column of the Scale. This revised Scale of Fees, which is being prepared in consultation with the British Dental Association, is to be introduced as soon as possible, but it will inevitably be some time before it is ready.

3. In order to avoid delay in the introduction of the increase in remuneration the Minister has therefore agreed that, as an interim measure, the present Scale will no longer be subject to the reduction of 10 per cent which was introduced in May, 1950.

4. The deduction of 10 per cent will no longer be made from the fees scheduled by the Dental Estimates Board for payment to dentists where the schedule is dated on or after May 1, 1955.

5. The effect of this increase in fees on the payments made by patients is as follows:—

(i) *Charges for dentures under the* 1951 *Act.* These remain unaltered. The difference between the patient's contribution and the increased fee payable for dentures will be included in the payment made by the Executive Council to the practitioner.

(ii) *Charges for treatment under the* 1952 *Act.* The maximum of £1 remains unchanged. Where the contribution from the patient is less than £1 it will have to be calculated on the new basis in all cases where the contract between dentist and patient is made on or after May 1, 1955.

In the case of contracts entered into before May 1, 1955, but not scheduled by that date the patient's contribution under the 1952 Act will already have been agreed with the patient, and will have been calculated on the old basis. Similarly, where the Executive Council have notified to the patient before May 1, 1955, the amount of his contribution for replacement of an appliance under Regulation 25, the Council will have assessed it on the old basis. In both these cases no increase should be made in the contribution to be paid by the patient. The amount already settled should be collected from the patient and the balance between that and the new fee will be paid by the Executive Council in the ordinary way.

6. A copy of the Regulations introducing this change is enclosed.

INQUIRY INTO SHORTAGE OF DENTISTS

THE Inter-Departmental Committee, under the chairmanship of Sir Arnold McNair, which has been set up by the Minister of Health and the Secretary of State for Scotland to ascertain the reasons for the lack of candidates for training as dentists, has now held its first meeting and is ready to receive evidence.

Persons or organizations wishing to give evidence should, in the first instance, communicate in writing with the Secretary of the Committee, Mr. T. C. L. Nicole, at the Ministry of Health, Savile Row, London, W.1.

MINISTRY OF PENSIONS AND NATIONAL INSURANCE

"Everybody's Guide to National Insurance"

A NEW booklet, *Everybody's Guide to National Insurance*, was published by Her Majesty's Stationery Office on Thursday, April 21, and is on sale at Government Bookshops, at all local Pensions and National Insurance Offices, or through any bookseller, price 6d. (by post, 7½d.)

A knowledge of the rules of National Insurance is vital to every contributor. This concise 32-page guide, prepared by the Ministry of Pensions and National Insurance and the Central Office of Information, explains how the two schemes of National Insurance—the main scheme (compulsory for nearly everyone) and the industrial injuries scheme (compulsory for everyone working for an employer)—operate. It gives the new rates of contribution which come into force on June 6 and lists fully the new rates of benefit, some of which are now in operation.

It tells who pays contributions, what the benefits are, and the conditions on which they are paid. It also advises how to claim benefits and, particularly, when to claim them.

In a foreword to the booklet the Minister of Pensions and National Insurance, Mr. Osbert Peake, says; "Britain is rightly proud of her system of social security, built up and developed over the last forty years. National Insurance, the backbone of the system, is well suited to our way of life, with its emphasis on the responsibility of the individual to provide for the future needs of himself and his family. By knowing the rules of the National Insurance schemes you can safeguard your right to the benefits."

A Study of Efocaine

An investigation into the properties of a long-lasting local anæsthetic solution, which the manufacturers claim will safely produce anæsthesia for twelve to fourteen days, has shown that it causes severe toxic reactions in experimental animals. Efocaine and each of its constituents, including procaine, polyethylene glycol, and propylene glycol, were injected by various routes into a number of hamsters, rabbits, and dogs, which were sacrificed and examined at varying intervals after injection. In all injected areas Efocaine produced complete necrosis. In the case of superficial injection, sloughing and ulceration occurred. Given intravenously or intraperiotoneally, opisthotonos, cyanosis, loss of equilibrium, respiratory arrest, and death rapidly supervened.

The author concludes that Efocaine in its present form is a dangerous, toxic drug.—JURGENS, P. E. (1954), *J. dent. Res.*, **33**, 665.

THE PROCEEDINGS OF THE BRITISH SOCIETY OF PERIODONTOLOGY

President: F. E. HOPPER, B.D.S., F.D.S. R.C.S.

Hon. Secretary: A. BRYAN WADE, B.Ch.D., F.D.S. R.C.S.
The Royal Dental Hospital, Leicester Square, London, W.C.2

Vol. V, No. 4 May, 1955

OCCLUSAL EQUILIBRATION IN GENERAL PRACTICE*

I. INDICATIONS FOR TREATMENT

By **R. J. G. GREWCOCK**, L.D.S. R.C.S.

OCCLUSION is now considered as a dynamic state, intimately related in function to the other main parts which constitute the masticatory system—namely, the musculature and temporomandibular joints.

An ideal occlusion should possess certain characteristics and be productive of certain forces to ensure that the component teeth are maintained in healthy function.

It is not suggested that every occlusion should be reduced to a common denominational extreme, but nevertheless certain fundamental characteristics of the so-called ideal occlusion must be expressed in order to appreciate those factors subscribing to the destruction of the tooth-supporting tissues and ultimately the dental arch itself.

REQUISITES OF THE IDEAL OCCLUSION

Some characteristics of the ideal occlusion can be summarized as follows:—

1. Continuous arch of teeth with complete interproximal contacts to promote equal stress distribution;

2. Equalization of stress distribution in centric occlusion, when the load is probably at its greatest;

3. Freedom of movement during lateral excursions to obviate horizontal overstressing.

Beyron (1954) has stated that a multidirectional gliding pattern constitutes mandibular movement which is most favourable to the welfare of the tooth-supporting structures.

THE FORCES OF OCCLUSION

All stresses conveyed to the teeth are transmitted as a stimulus to the supporting tissues and may, or may not, be considered favourable to their development and maintenance.

Occlusion can be said to manifest itself clinically in two basic forms of force:—

1. Vertical loading in which the occlusal force acts along the long axis of the tooth, a direction which is considered to be probably the most favourable;

2. Horizontal loading, which is applied obliquely to the long axis and results in resolution of forces and torque production.

All forces acting on the teeth are balanced by the resistance of the periodontal tissues, so that it can be said that an ideal occlusion is one when each tooth is in contact with its opponent in such a way as to subject its supporting tissues to stresses which they are best able to withstand.

Excessive stresses in an axial direction are better capable of being withstood and compensated than those applied horizontally.

Periodontal destruction can be accomplished either by excessive forces acting on the teeth themselves or by degeneration and consequent weakening of the tooth-supporting structures (*Fig.* 1).

* Being a symposium given at the Eastman Dental Hospital on Monday, February 7, 1955.

It can be said that normality of occlusion as an entity is impossible to assess, since the factors constituting its stability lie more in the supporting tissue reaction and resistance to the forces applied.

Having in mind as a basis a certain brief picture of what may be expected to constitute the ideal occlusal state, it is possible to discuss what conditions indicate occlusal reinstatement.

Fig. 1.—Showing apical resorption of the upper incisors due to excessive rapid retraction by means of a removable appliance.

INDICATIONS FOR OCCLUSAL EQUILIBRATION

1. Orthodontic Treatment where priority has been given to æsthetic improvement with little consideration for the occlusion, musculature, and temporomandibular joints.

Varying malocclusions are seen, from simple premature cusp contact in the normal path of closure to absence of multiple teeth contacts with the resultant lack of functional stimulation to the supporting tissues of the teeth affected.

2. Tooth Extraction with the inevitable adjacent tooth drift, loss of interproximal contacts, and consequent food impaction and stagnation.

Since the pattern of mandibular movement is controlled by the ease (or difficulty) with which excursions can be carried out, it is important to emphasize the far-reaching disturbances that the extraction of even one tooth can sometimes create.

For example, removal of a lower molar tooth is often followed by extrusion of its antagonist in the upper jaw, which in time dominates the scene and prevents further excursive movements to the opposite side (*Fig.* 2). A result often seen is lengthening of the upper incisors and canine on the side where tooth contact in the protrusive position is now no longer possible.

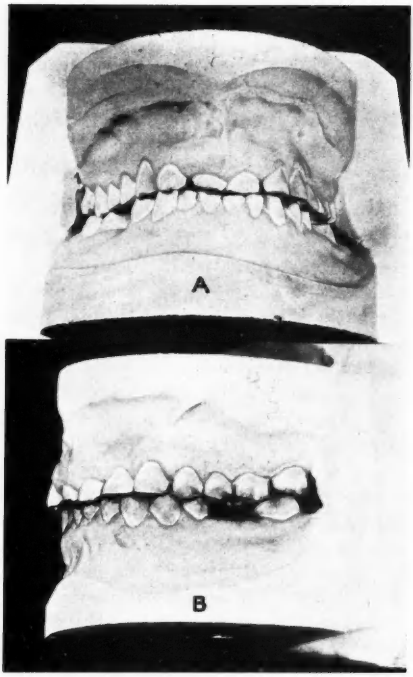


Fig. 2.—Extraction of $\overline{6}$ with subsequent tipping of $\underline{6}$, prevented mandibular excursion to the right side. All chewing was done in the left anterior segment, with resultant excessive attrition. **A**, Frontal view, **B**, Lateral view.

A new unilateral movement pattern is created which is considered to be less favourable.

Since movement of a tooth out of contact with an antagonist does not always follow, it would seem likely that extrusion is largely dependent on gingival health.

3. Raised Fillings, Inlays, and Bridge Work, probably constitute one of the main factors in the production of malocclusion and unilateral mastication.

In order to avoid an uncomfortable tooth contact a bite of convenience is adopted and promoting the muscle spasm of temporo-mandibular joint dysfunction.

4. Bruxism or forced grinding of the teeth either by day or night is usually the result of malocclusion, and is based on the patient's subconscious urge to grind off any cusps which

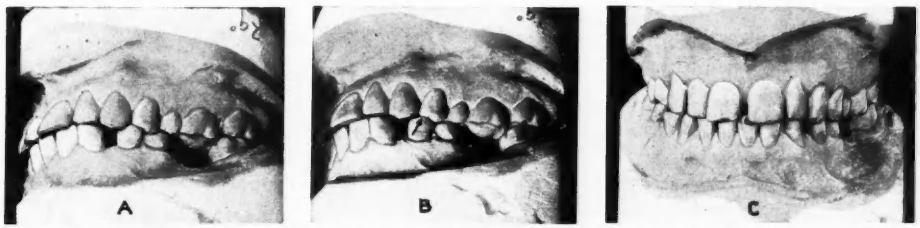


Fig. 3.—Premature contact on $\overline{|4}$ during the normal path of closure is shown in B. A, shows the mandible in its final forward position of closure, and C the resultant proclination of incisors.

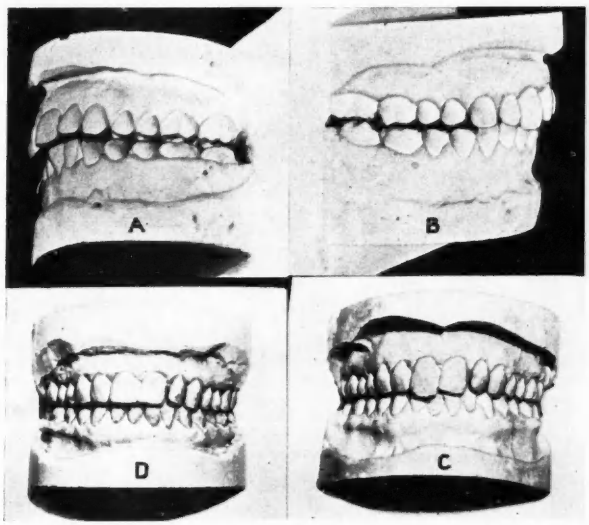


Fig. 4.—A case of bruxism. A, Showing premature contacts on the left molars. B, Showing no contact of posterior teeth on right side during premature contact. D and C, Demonstrating the æsthetic improvement effected by reduction of the incisal tip length.

the mandible moved to an eccentric mandibulo-cranial relationship which can be anterior, posterior, or lateral to centric occlusion.

A forward thrust of the mandible on closure is often productive of upper incisor proclination (*Fig.* 3), whilst lateral and/or posterior displacement can be the initiating cause in are preventing the mandible assuming its centric position (*Fig.* 4). Similarly a completely flat occlusion with no centric definition will induce a forced attempt at auto-registration of centric occlusion.

5. Æsthetics.—It would appear that a conscious reluctance to grind teeth grips the

dental profession as a whole. Yet, how often the lip line can be improved and a better functional result obtained by reducing the tips of upper incisors (*Fig.* 4).

This has a natural effect, too, in the protrusive bite of distributing the load more evenly over the anterior segment.

Teeth with a marked degree of looseness i retained must be firmly stabilized by fixed o removable splints.

Cases which show a tendency to recurren periodontal tissue degeneration should b examined clinically for centric occlusion and freedom of lateral movements and any

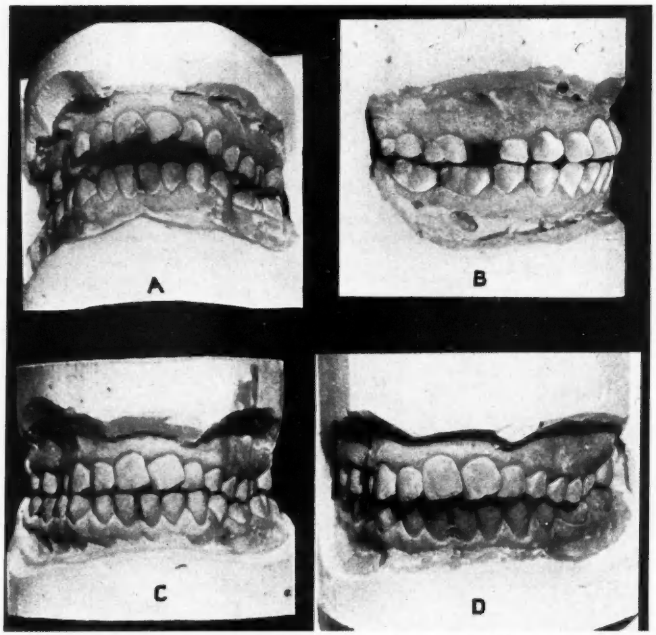


Fig. 5.—Anterior open bite. A, Before reduction in the occlusal vertical dimension. B and C showing closure by selective grinding—the mandible is in the protrusive position. D, In centric occlusion.

Certain cases of anterior open bite in the adult respond well to modified bite closure by selective grinding (*Fig.* 5), but serial radiographs of the temporomandibular joint should be taken to avoid marked overclosure with retro-positioning of the condyles.

6. Following Periodontal Treatment.—It is unlikely that trauma *per se* is usually the primary cause of periodontal destruction. The institution of centric occlusion, free lateral gliding movements, and equal stress distribution, however, constitute a necessary part of treatment by establishing a harmonious state of function.

necessary adjustments made following the usual periodontal treatment.

7. Correction of the Occlusal Vertical Dimension.—If examination of all were possible it would be found that many people show evidence of some degree of bite closure (*Fig.* 6).

Most have few positive clinical manifestations and no subjective symptoms worthy of note. In treating cases of closed bite great care must be exercised in differentiating between deep bite and the condition of true mandibular overclosure. A deep incisor overlap, as in Angle's Class II, Division 2, is certainly no criterion of bite closure.

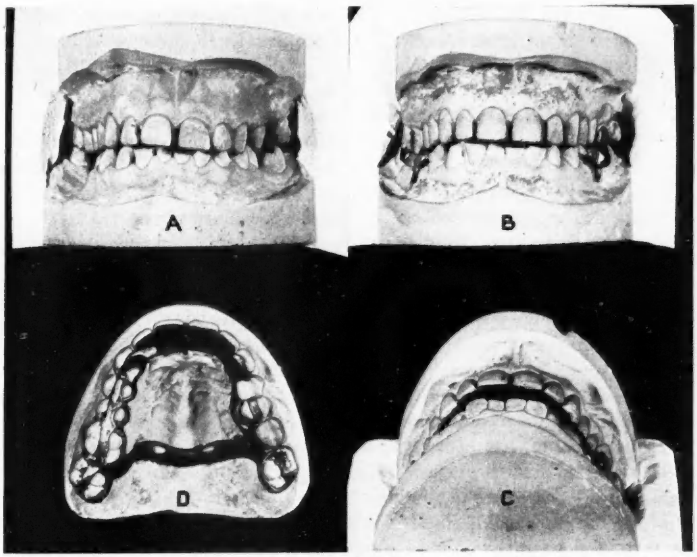


Fig. 6.—A, Showing incisal proclination following slight bite closure; B, Modified retraction of incisors; C and D, Retention of the upper anterior segment by a pin/splint.

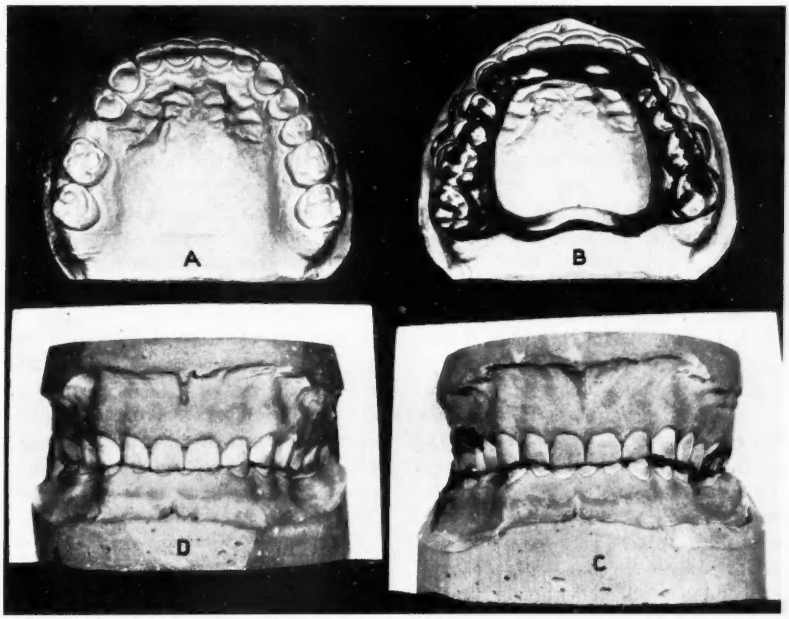


Fig. 7.—A and D, Excessive attrition due to bruxism. B, The type of splint employed, and C, the degree of bite opening obtained.

Absence of posterior teeth, lingually inclined molars, tilted teeth, etc., are suggestive of a lowering of the normal occlusal level: a large interocclusal clearance of 8–10 mm. increases the possibility, and radiographs of the temporomandibular joint will sometimes do much to confirm the diagnosis. Patients with marked occlusal attrition should not be automatically regarded as closed-bite cases, since the normal occlusal vertical dimension is usually retained by virtue of the compensating upgrowth and downgrowth of the mandibular and maxillary supporting bone (*Fig.* 7).

Angle's Class II, Division 2 cases usually exhibit predominantly sagittal chewing movements and are often notable for the high degree of resistance of the periodontal tissues to degenerative changes just as long as no excessive lateral forces are developed by bruxism.

It is of interest to see radiographically that this sagittal movement pattern is confirmed by the deep nature of the temporomandibular joint fossæ usually present in these cases, and no attempt should be made to give the articulation more movement than a slight lateral shift.

Palate biting by the lower incisor teeth, posterior to the upper anterior segment, and/or trauma to the soft tissue in the lower labial sulcus can be attributed to either bite closure or upgrowth or downgrowth of the anterior teeth segments.

It will be found that relief of pressure by grinding the tips of the lower incisors is of temporary value only, unless a palatal biting platform is inserted to promote axial stress to the lower incisor teeth in centric occlusion.

8. Temporomandibular Joint Disorders.—Every patient with suspected temporomandibular joint disorder should be examined for occlusal imbalance before more radical measures are even contemplated, since 80 per cent of cases are improved or cured by occlusal reconstruction.

Two main characteristics, neuromuscular spasm and temporomandibular joint imbalance are common to and recognizable in cases of temporomandibular joint dysfunction, while two common factors appear to provide the necessary stimuli—namely, a localized periarticular muscular hypertonicity and an occlusion with an eccentric functional relationship with or without a reduction in the occlusal vertical dimension.

Centric occlusion assumes a correct balance of each condyle in its respective fossa, so that any deviation from this mandibulocranial relation is reflected in altered condylar position and exaggerated periarticular muscle function.

What are the clinical indications for occlusal equilibration in temporomandibular joint disorders?

Deviation of the Mandible from centric occlusion by premature cusp contact(s) results in the adoption of an eccentric functional occlusion with an accompanying mechanical upset to both musculature and joints. In cases of 'snapping' noises in the joints, clinical interest should be concentrated first on the examination of upper incisors and canines, in particular, for the presence of cingular attrition facets.

It is important to appreciate that to produce symptoms, mandibular displacement can on occasions be slight indeed, as little as 1–2 mm., so that any deflection from centric occlusion should be corrected regardless of degree.

It is remarkable indeed to note the rapidity with which symptoms can so often be alleviated following correction.

Alteration in the Occlusal Vertical Dimension.—Backward and/or upward condylar displacements can occur only in cases where occlusion in the posterior segments allows mandibular displacement from the centric relation.

Occlusion permitting, condylar retrusion is largely dependent on muscular hypertonicity.

Retroposition of the condyles can be detected by X-rays (Grewcock, 1953).

It is heartening to observe the resistance of the joints to permanent injury and irreparable changes in bony structure, so that radiographical evidence of hard-tissue destruction is seen in only a few advanced cases.

REFERENCES

Beyron, H. (1954), "Occlusal Changes in the Adult Dentition", *J. Amer. dent. Ass.*, **48**, 674.

Grewcock, R. J. G. (1953), "A Simple Technique for Temporo-mandibular Joint Radiography", *Brit. dent. J.*, **94**, 152.

II. DIAGNOSIS AND TREATMENT

By **HAMISH THOMSON**, H.D.D. (Edin.), L.D.S. (Glas.), D.D.S. (N.U.)

My part in this symposium is to discuss diagnosis and treatment methods. It is my intention, however, to express some opinions on definitions and requisites which I hope you will agree are relevant.

The dictionary defines "equilibrate" as "to cause (two things) to balance", from which it is reasonable to deduce that occlusal equilibration means the act (or art) of balancing the occlusal surfaces of the teeth of upper and lower jaws. The dictionary also defines "equilibrist" as a rope walker or acrobat. From this a significant moral might be drawn which need only be stated and not laboured, namely, that he who would equilibrate is liable to cause imbalance to himself and to the equilibrated, if the greatest care is not taken in both diagnosis and treatment. The next speaker will undoubtedly speak to this somewhat clumsy aphorism and, meanwhile, I take up my position on the fence in a state of near balance, but with an open eye on the grass that grows on either side.

With regard to definitions, it has to be admitted that the profession uses the word "occlusion" in a wide sense to cover all contact relationships of the teeth whether centric or eccentric, static or dynamic. It might be helpful to think of occlusion as a static relationship of the teeth and to append the adjective "centric" when the occlusion corresponds to that relationship when the muscles are holding the jaws together, through the medium of the teeth, in optimal contraction. Any other occlusion than centric may be termed "eccentric", and any movements between such occlusions may be termed "articulation". Any plea for a dynamic state in tooth relationships must, therefore, apply to articulation.

The first speaker's three requisites for the ideal occlusion (which includes articulation) are desirable, but one should consider carefully the cause and effect of any deviations from this ideal before attempting to attain it in patients' mouths. This necessitates most careful diagnosis, with particular regard to the relationship between the muscles in optimal contraction and the occlusion.

A fourth requisite might be added—namely, an equalization of muscle forces between those within the dental arches and those without. For example, a tongue, thrusting forwards during the swallow, may exert a force which the lips cannot equalize, and the teeth between these two muscle forces may move in response to the stronger force. By the same token an equality of such muscle forces may maintain teeth, unsupported by adjacent members, in correct alinement in the arch. A continuous arch of teeth, therefore, is not necessarily without its problems, though no one will deny its desirability.

Equalization of stress in centric occlusion is desirable, but the requisite is incomplete as stated. This occlusion should be related to the rest position of the jaws. The free-way space between the jaws is a fairly constant one for each individual, and the path of closure from rest position to centric occlusion, in the ideal or average, is uninterrupted until all the teeth meet together with the muscles contracting optimally. By optimal contraction is meant the equal contraction of both sets of muscles on either side of the jaw at a vertical height beyond which contraction might lead to disturbances either within the muscles themselves or to the supporting or surrounding tissues of the teeth or even to the tissues involved in the mandibular joint (*Fig.* 8 A, B, C). The relationship between centric occlusion of the teeth and the musculature of the jaws is a delicate one which the organism attempts to maintain, and generally does so. Muscle is the dominant tissue and does not always tolerate changes in its optimal contraction, such as may be caused by altered tooth positions leading to altered jaw relationships. The disturbances that may follow have just been mentioned and the fact that they do not always follow is no reason to doubt their existence when they do.

When occlusion of the teeth does not correspond to centric occlusion this relationship is called habitual occlusion and it implies an abnormality. It is for the dentist to diagnose any such deviations from centric to habitual occlusion and to decide if they are harmful. In the opinion of this speaker centric occlusion, and its recognition, is of the greatest importance. Anyone who has made full dentures must be aware of this fact, and the

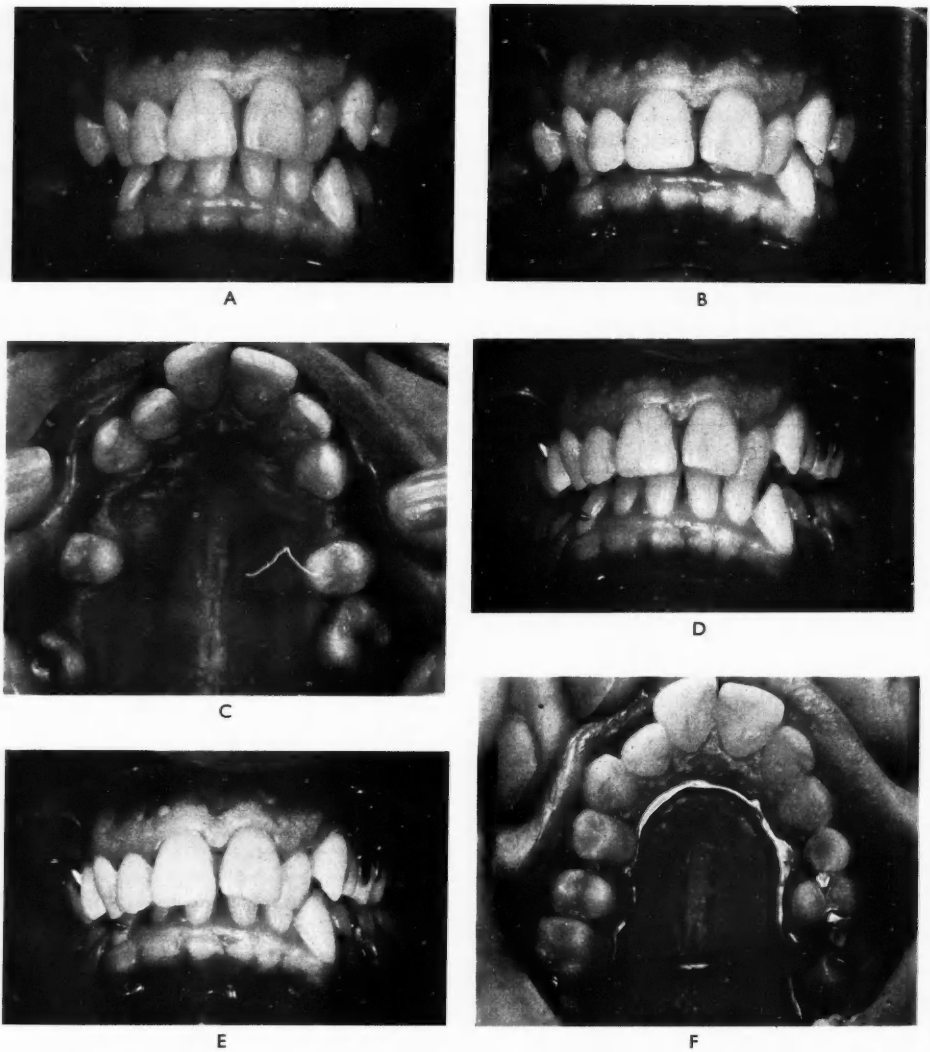


Fig. 8.—Patient presented with symptoms of mandibular joint pain and soreness in the palate. A, Rest position; B, Habitual occlusion; C, Effect on palate; D, Rest position with prostheses in place, but jaw relationship unaltered from A; E, Restored centric occlusion; F, Palatal bar to contact lower incisors.

point of the analogy is that the muscles play the same dominating role in both branches of dental disturbance, diagnosis, and treatment. Balanced articulation, on the other hand, is of lesser significance in the natural dentition and, to complete the analogy, of a greater significance in full dentures. This opinion is expressed for the following reasons. In the average chewing range it is submitted that the teeth seldom, if ever, come into occlusion, centric or eccentric,

A B

Fig. 9.—Patient presented with mandibular joint pain. A, Eccentric occlusion adopted in the empty mouth and causing attrition of the teeth; B, Protective bite splint for night wear and for wear during the day when patient conscious of grinding the teeth.

except in the act of swallowing when centric, or habitual, occlusion is adopted in order to stabilize the jaws. This would seem to be the only occlusion adopted in normal function, and a centric one is, therefore, desirable. Articulation of the teeth is attempted only during the empty movements of the jaws, and it is thought that this may be due to the muscles trying to restore a disturbed, or habitual, occlusion to centric, or to stimuli from diseased periodontal tissues, or possibly to stimuli from the psyche.

Treatment by occlusal equilibration has four main objectives:—

1. Restoration of two complete arches.

2. Equal distribution of stresses in centric occlusion and with the implication of an uninterrupted free-way space of normal dimension.

3. The correction of harmful strosses on teeth in articulation between centric and eccentric occlusion during the empty movements.

4. The diagnosis of disturbing muscle forces from within or without the arch, and the correction of the arch to conform with these forces by orthodontic methods, or the splinting of the affected teeth to as many sound teeth as possible.

Treatment should be based on a bite analysis which comprises:—

1. A study of the path of closure of the lower jaw from rest position to centric or habitual occlusion. This is done on the patient and on study models mounted on the adjustable articulator. Thus the extent of the free-way space and any interruptions to the path of closure may be determined.

2. A study of the muscle forces from within and without the arch, and best done by an orthodontist, in order to determine any disturbing forces and what their effect is or might be.

3. A study of both arches to determine how completely to restore them. This is done in the mouth and on study models.

4. A study of the eccentric, empty movements as used by the patient in order to determine whether these movements are harmful and if they should be corrected or equilibrated. They are usually well signposted by the facets of wear on the affected teeth and best recognized on study models, then confirmed on the patient (*Fig.* 9 A).

5. An analysis of the above findings should be studied in relation to the patient's signs and

symptoms whereupon a treatment plan can be decided.

Treatment Methods.—

1. Any orthodontic treatment following the diagnosis of muscle balance.

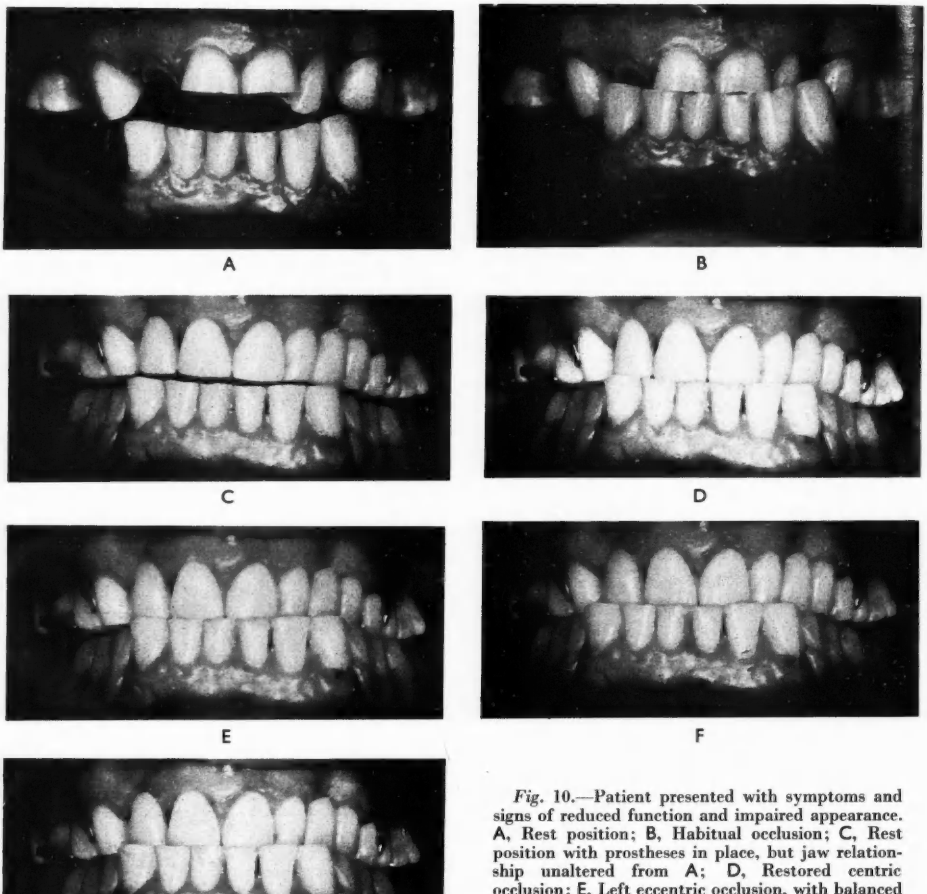


Fig. 10.—Patient presented with symptoms and signs of reduced function and impaired appearance. A, Rest position; B, Habitual occlusion; C, Rest position with prostheses in place, but jaw relationship unaltered from A; D, Restored centric occlusion; E, Left eccentric occlusion, with balanced contact on the right; F, Right eccentric occlusion with balanced contact on the left; G, Protrusive eccentric occlusion with balanced contact in both posterior segments.

2. Selective grinding which is essentially an attempt to restore an uninterrupted path of closure so that the muscles can pull the jaw from rest position to centric occlusion without deviation, and implying simultaneous contact all round the arch. The safest method is to perform the grinding on models mounted in rest position on the adjustable articulator and bring about the desired result. Then assess how much of this can be done on the patient, and approach the operation gradually. The patient will usually provide encouragement, or not, about the sensations of improvement, or otherwise, and such an empirical approach has been found to be rewarding, at least in this

operator's hands. One thing should be borne in mind when checking the bite during the progress of the operation—namely, that from the open-mouth relationship the patient will invariably close to the habitual occlusion. The path of closure should be checked always from the rest position.

Selective grinding to provide balanced contacts for eccentric occlusions in the empty movements is carried out where deemed necessary and care is taken not to disturb the centric occlusion. An alternative form of treatment is the placing of a bite splint to obviate damage (*Fig.* 9 B).

3. Restoration of the arches by the most fixed prosthetic measures possible, and here a strong plea is made for balanced articulation on prostheses (*Figs.* 8, 10).

4. Restoration of lost vertical dimension or of displaced centric occlusion by prosthetic measures, if this be deemed necessary, for the treatment of gingival or periodontal trauma or of disturbances to the mandibular joint (*Fig.* 8 D, E, F). Any alteration of the bite height must only follow a careful analysis and trial removable splint. Permanent restoration of the bite height may be achieved by removable metal cover splints or by fixed prosthesis.

5. Splinting of the teeth by removable or fixed methods. The fixed method is preferable in terms of stability for the periodontal tissues, but it is time-consuming, arduous, and costly. The principle involved is to attach the loose or drifting teeth to as many sound teeth as possible, and if any alteration in the occlusal vertical dimension is incorporated then all the teeth must be included.

Indications for Treatment by Occlusal Equilibration.—

1. Where occlusion is not centric and is causing a deterioration of periodontal or mandibular joint disturbances.

2. Where a grinding habit in the empty movements is causing a deterioration of periodontal or mandibular joint disturbances.

3. Where a loss of occlusal vertical dimension is contributing to a mandibular joint disturbance or to trauma of the gingival or periodontal tissues, or contributing to a drifting of teeth.

4. Where a muscle imbalance is contributing to a drifting of teeth and consequent periodontal disturbances.

5. Where the teeth are loose and continue to be loose after routine prophylactic measures.

Thanks are due to Professor F. C. Wilkinson, Director of the Eastman Dental Hospital, for permission to publish the photographs, and to Mr. D. R. McDougall for producing them.

III. CONTRA-INDICATIONS

By **A. R. F. THOMPSON**, B.D.S., F.D.S. R.C.S., M.R.C.S., L.R.C.P.

You will notice the specific title of this discussion and therefore I would like, as a general practitioner, to point out the relative incidence of some of the conditions we are discussing.

Speaking for myself and for some of my general practitioner colleagues, we find periodontal disease ubiquitous and temporomandibular joint disturbance quite uncommon. Moreover we find, of the few patients who complain of temporomandibular joint disturbance, that the majority get better without treatment and we suspect a few get better in spite of treatment.

Despite this I am satisfied that although there is a great deal of esotericism in this subject, there are nevertheless quite clear cases in which the teeth occlude in a relationship which is not a centric one. The odd thing is that if a watch is kept for such cases they by no means all exhibit temporomandibular joint symptoms.

The last word can hardly be said, and I would accept no conclusions under a decade of impartial observation of treated cases and untreated controls in temporomandibular joint disorders. It must be remembered that the success of the patent medicine industry depends on the shortness and inaccuracy of men's memories and upon their wish to be convinced.

An ancillary fallacy lies in the assumption that anatomical articulators reproduce the

movements of natural teeth. I suggest you have models of a natural dentition mounted on a Hanau or Dentatus articulator by a practised occlusal equilibrator, and then try and see if the facets of wear can be made to meet as they do in the mouth. I have propounded this experiment to a famous exponent, who splintered the plaster teeth in his efforts to convince me that his views in this matter were correct.

In spite of this fact, I would not like it thought that I consider anatomical articulators are useless. For full denture prosthesis they are essential and for partial dentures and bridges they are a helpful guide, but in the latter connexion they do not eliminate the extensive use of articulating paper in the mouth. For twenty-five years I have continuously advocated the use of the Hanau articulator against widespread scepticism for these purposes.

Almost exactly five years ago I subscribed in the *Dental Delineator* (1950) to certain views decrying the value in effect of occlusal equilibration in the treatment of periodontal disease. To-day, having re-read this article, I am relieved to be able to say that I found no substantial reasons why I should retract a word.

In short, the articles of my creed are:—

1. The presence or absence of periodontal disease or rather the risk of its onset depends in the adult almost entirely on the biological integrity of the soft-tissue attachment. Given, or more correctly inheriting, strong attachments, the teeth can be hopelessly misplaced and filthy and yet remain firmly in the jaws long after other classically arranged teeth in a "clean" mouth have literally fallen out.

2. Substantially the views expressed by Warwick James and Counsell (1927), that the primary lesion is situated at the point of attachment, holds to-day as it did when formulated. If the epithelium is up to its job of keeping out substances harmful to the tissues beneath and keeping in the tissue fluids, all is well. If it fails to keep out bacterial toxins, all is ill.

Primary damage arising in depth in the periodontal membrane undoubtedly occurs as a result of general systemic disease, which is usually of sufficient gravity that neither the patient nor dentist will be interested in the sort of procedure we have in mind to-night. I suggest, therefore, that for our immediate purpose we can take only the Warwick James and Counsell view. Even if it is admitted that in minor degrees of general ill health the body fluids may bring an unsatisfactory environment to the cells of the whole periodontium, still the principal lesion is at the attachment.

3. Continuous eruption, a scientific fact, is nevertheless a clinical red herring as far as our present discussion goes. It has been demonstrated that, after a tooth is fully erupted in the traditional sense, it then continues, as it were, to grow in length by the rootward apposition of cementum to an amount which is roughly commensurate with occlusal wear and probably dependent upon occlusal function. This continuous eruption has been seized upon by some of us and confused and merged mentally with the very different and gross movement known otherwise as drifting or extrusion and associated with the onset of periodontal disease.

In the absence of demonstrable gingival margin disease which *a priori* implies a biologically sound epithelial attachment, a tooth frequently will not move out of its station even in thirty years when unantagonized, whether this lack of opponent is due to a major derangement of the jaw relationship, a local derangement, or merely an extraction. It must of course be admitted that many unantagonized teeth are in an unfortunate position with regard to self cleaning, but there is still much substance in the contention as stated.

On the other hand, in the presence of clinical gingival disease the conservative operator, who prepares a tooth for a full crown, will leave the occlusion unguarded at his peril. Even in one week without a proper temporary cap, a serious loss of the occlusal space previously created will have occurred. At this point I wish to quote the following passages from the paper quoted at the outset:—

"Teeth arrive in their ultimate working position as a result of patterns inherent in

phylogeny and modified by environment. In other words they have certain potentialities of eruption. Generally speaking these potentialities are exercised and the teeth come into functional occlusion, but in the travelling into occlusion they are subjected to the accidents inseparable from existence, they are also subjected to the inherent growth patterns of the rest of the body. The general result of this process is that, when a tooth erupts to or near the position of normal eruption, the urge to continue erupting seems clinically to diminish to negligible proportions, in the healthy tooth, even if there is no antagonist in the opposing jaw. There is one common condition which will initiate gross continuous eruption and that is periodontal disease.

"In other words, clinically speaking, teeth do not over-erupt until they commence to be seriously affected by periodontal disease, and, whatever may be the cause of the disease, it primarily is not malocclusion, although it may be aggravated by it."

The clinical facts supporting these views are as follows:—

1. Under normal conditions teeth erupt until they meet their opposite numbers in occlusion.

2. Having achieved occlusion, if a tooth should then lose its antagonist, either it will continue to move in a vain effort to establish occlusion or it will remain *in statu quo*.

3. The not inconsiderable number of teeth which remain *in statu quo* under condition (2) will be found almost invariably to be periodontally sound.

4. Commonly, these teeth which show continued eruption under condition (2) also exhibit periodontal disease.

5. Moreover teeth may remain stationary under condition (3) for some years, and then may deteriorate periodontally. They will then commence to erupt or to drift in some non-axial direction.

6. A tooth which is loose and demonstrably in traumatic occlusion, may be ground so that it is no longer mechanically traumatized. Dramatically the tooth becomes firmer for a few days. Not so dramatically, but just as certainly a few weeks later the tooth will be found to be loose again, if anything looser still, because relatively its clinical crown is now longer and its clinical root shorter.

7. In cases of cleft palate which have been subjected to "Lane" or "Brophy" operations, the teeth erupt eventually in the most irregular manner and only a small proportion of the teeth are ever in occlusion with the lower teeth. The malposed teeth erupt more or less at their own proper times and, having done so, stay unantagonized and stationary for long periods.

8. Gross periodontal disease is sometimes seen in dentitions which are models of mechanical occlusal balance.

9. Impacted third molars have frequently been relieved of their impaction by extraction of the second molar, at some time after the usual date of eruption. Such teeth do not then usually erupt until periodontal disease becomes active. They may tilt, but that is another matter altogether.

10. There are various and not uncommon irregularities of the jaws, which leave teeth grossly out of occlusion. The incisors in open bite cases and unilateral premolar open bite are among the more usual examples.

To recapitulate; it is a common clinical finding that teeth may be in non-occlusion for many years and yet are found to have negligible pocketing or gingivitis. On the contrary, teeth which are in traumatic occlusion will almost invariably be found to have severe periodontal disease primarily.

The issue must not be confused by cases of true traumatic occlusion, that is where the dentition has been mutilated by trauma, so that a musculature suitable for powering a full dentition is suddenly let loose on just a few remaining incisors; nor with those situa tions where soft tissue pressures and occlusion are in disequilibrium.

The analogy frequently used, comparing the dental situation with that of a machine, is thoroughly untrustworthy. For example there is no value in the suggestion that teeth should meet and convey stresses axially. There is no biological precedent or need for such an arrangement, and still less value in any attempt to convert stresses to an axial

direction or to prevent the occurrence of non-axial stresses. Upper and lower incisors in good occlusions meet at a mean angle of 135° approximately and could hardly be less axially coincident, and even were they contrived so as to be ball-and-socketed together, the stress incidence would be unaltered.

If, during growth, the muscle patterns were such that the teeth were permitted to take up positions which preclude say, lateral excursions, it is most unlikely that removal of the parts of the teeth apparently so obstructing lateral movement will induce a change in the musculature established so long ago.

It is necessary clearly to distinguish between continuously acting forces such as those reciprocally provided by lips and tongue during repose, and those which act momentarily and are not reciprocated. In the absence of periodontal disease teeth are not moved by huge forces, but in health, and more so in disease, they are moved by lip and tongue action of relatively trivial force.

It is also fallacious to consider that nothing short of substantially the whole of the theoretically available occlusal surfaces should meet simultaneously. In fact, provided the force on each tooth is within its capacity to resist dislodgement, no harm will be done and greater force will be brought to bear on the morsel if fewer, rather than more, teeth are in contact. The analogy of the scissor effect would seem sound in this connexion.

In those cases where teeth are in secondary traumatic occlusion there seem to me to be only two logical solutions. Either the tooth or teeth must be extracted or they must be anchored by crowns or inlays to each other and to untraumatized teeth. It is then practical to have those parts removed which are in traumatic relation with their antagonists.

Summary.—Logically there are only two processes possible to obtain occlusal equilibration, apart from fixed bridgework which I advocate strongly. Either the teeth are ground down or are made longer by some form of fixed or removable inlay or onlay. If on the one hand the tooth is to be reduced in height, it must be ground slightly or grossly. If the former it is difficult to see why trivial adjustments had not been made by wear and/or "natural orthodontics". If the latter the teeth are made sore or probably disfigured.

Nothing in this last paragraph should be taken to mean that quite considerable grinding of the upper incisor edges, for æsthetic purposes, should not be done. This is, in fact, a practice with much to recommend it, provided Class III fillings are not turned into Class IV fillings.

Occlusal equilibration in the treatment of periodontal disease, either as a prophylactic measure or as a curative measure for established disease, is not worth the time spent on it and may have considerable disadvantages.

Occlusal equilibration in the treatment of derangement of the temporomandibular joint has positive value and is essential for some cases. This subject is hardly one for general practice or for cases within our terms of reference.

Occlusal equilibration is an essential when large parts of the occlusion are replaced, or added, as when large bridges or dentures or periodontal splints are constructed.

REFERENCES

BALLARD, C. F. (1953), "An Orthodontic View of Occlusion in Relation to Periodontal Problems", *Dent. Practit.*, **3**, 311.

HANKEY, G. T. (1954), "Temporomandibular Arthrosis", *Brit. dent. J.*, **97**, 249.

JAMES, W., and COUNSELL, A. (1927), "A Histological Investigation into 'So-called Pyorrhœa Alveolaris'", *Ibid.*, **48**, 1237.

THOMPSON, A. R. F. (1950), "A Plea against Irrational Restorative Dentistry", *Dent. Delineator*, **1**, 3.

The Dental Board

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